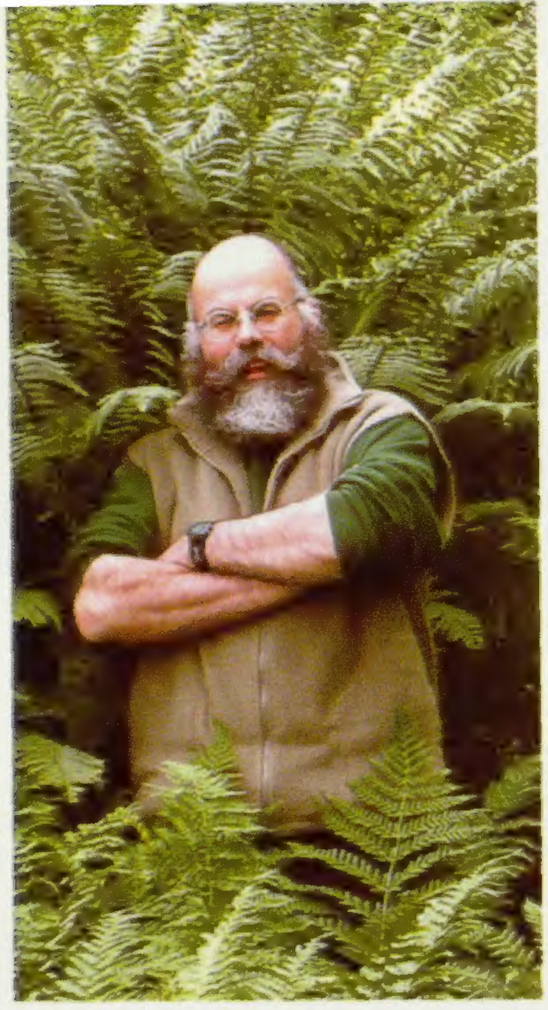

James Merryweather - ed.

EDITORIAL

Have you noticed that ferns are appearing more often for sale and in the media? It's splendid that they should be firmly implanted in the public consciousness, but they are so often misrepresented I wonder if there is a reasonable balance between advantageous exposure and disadvantageous misinformation?

I shudder when ferns are proclaimed "Prehistoric plants", "Dinosaur plants" or, worse still, "Millions of years old", just because they have ancient ancestors. So do all other extant organisms and they have all been through the process of evolution together. Ferns today are what they always were: thoroughly modern plants. They've just been around longer than flowers. If anything, ferns might have nudged ahead of the rest quite recently in evolutionary terms (see page 66).

These days, TV garden make-overs usually include a few common ferns as well as one or two of the more exotic tree-ferns (Newsletter 10, page 80) which have become available in garden centres everywhere. *Dicksonia antarctica* and *D. squarrosa*, with fronds broken, stunted and twisted through maltreatment, can be seen struggling for survival in the garden department of many DIY superstores next to shelving crowded with desiccated, moribund *Dryopteris erythrosora*; *D. affinis* 'Cristata The King'; *D. filix-mas* 'Linearis' (which I detest because of its sheer ugliness - it must be cheap to propagate); polypodies called *Athyrium filix-femina* and *vice versa*; wild-type hart's tongues labelled 'Cristata' and a few other common wild ferns. The alternative can be seen in some nurseries where stocks of terrestrial ferns are displayed in a tray of stagnant water, rotting alongside pond plants and goldfish. I have watched gardening programmes disappointed by otherwise highly competent presenters who taught millions of viewers to plant maidenhair spleenwort in the gloom beside the trunk of a massive tree and hart's tongue (page 69) in a hastily prepared bog garden, freshly fashioned from sopping wet peaty compost.

Where do garden centre tree-ferns come from? They are too mature to have been grown economically from spores. They are collected in the wild, hacked off above ground level (legally and under license!) as the last of the Antipodean forests are cleared (page 81). They are saved from certain death, it's true, but purchasers are not warned that a few sharp British frosts will surely polish most of them off sooner or later unless they receive special protection every winter. Some outlets even provide the extraordinary bogus advice, printed on an authoritative instruction label attached to the trunk, that tree-ferns don't need their roots, but can be placed without pot or soil on your patio paving where they will obtain all they need from the atmosphere. It's as if the some suppliers *want* ferns to die in our gardens.

Common names of plants are delightful and can be useful when a botanical name is inappropriate, but they sometimes cause confusion. Recently, I heard a gardening guru refer to "the sedge *Ophiopogon*" (Liliaceae), but then they frequently call members of the genus *Carex* "grass"! Am I an over-zealous pedant or should we expect these front-line people to learn some basic botany before they teach? They also habitually misname the pernicious weed that even pteridologists are known to curse, field horsetail, but it was a *Gardener's Question Time* questioner who recently introduced its customary erroneous common name "mare's-tail" (the aquatic angiosperm *Hippuris vulgaris*). The experts did not correct him, but perpetuated the misnomer throughout the discussion. We cannot expect these experts to know everything (even if some of them pretend they do) so perhaps we should forgive them when they get entangled with a specialised subject, as became evident as the conversation progressed. They started to get on the right tack when they gave this "mare's-tail" the botanical name *Equisetum arvense*. That might have been the correct diagnosis, except I don't think *E. arvense* was the villain after all. The creeping weed they described increased downhill to become densest where the land was waterlogged, so I wonder if it could have been one of the wetland horsetails?

BPS PUBLICATIONS: HAVE YOUR SAY

ABOUT BPS PUBLICATIONS

On 7th June 2004 the BPS Publications Sub-Committee had a very creative meeting in Edinburgh. We identified a list of objectives of the Society's publications: a) to promote pteridology and the Society; b) to record BPS activities; c) to publish original research; d) to inform and entertain the members; and e) to provide an outlet for members' creativity. It was resolved that we should ask the membership to comment on the journals they receive annually, the *Bulletin*, *Fern Gazette* and *Pteridologist*. Please contact the editors to have your say so that the sub-committee can consider the improvements you recommend.

Continued on page 74

ADVICE FOR AUTHORS

Pteridologist welcomes contributions written in English on all aspects of the natural history and horticulture of ferns and related plants, indeed, anything fern-wise that will be enjoyed by a wide range of readers. Please refer to past editions for ideas regarding scope and presentation.

SCRIPT: Ideally text should be provided in the form of a WORD, RTF or TEXT file on a floppy disc, CD-ROM (PC or MAC) or e-mailed. Typescripts can be scanned or manuscripts laboriously typed. However, surely it is not the editor's job to sort out basic use of English. Authors are expected to use reasonably correct **splelngg**, **Grammer** and **punc;tua.tion**, and write in such a way that the **meaning** of the words is conveyed. **One space** between sentences and (I never thought I'd need to mention this) one space between words, please.

CONVENTIONS: Scientific names should be in italics thus: Polystichum setiferum, (if typed or in manuscript, underlined). Variety names should be in normal type, capitalised and enclosed in single inverted commas thus: Polystichum setiferum 'Plumoso-divisilobum'. Common names should be in lower case thus: soft shield fern.

ILLUSTRATIONS: As JPEG etc., but I have scanners so please send line art, good photo prints (accompanied by their negatives) or 35 mm slides which I will return. If supplying silhouettes ensure they are not of squashed and shrivelled fronds, but actually look like the fern they came from, and are of decent quality. Send files larger than ~200Kb on floppy disc or CD-ROM please, not by e-mail. **COPY DEADLINE: 31st November, 2004**

PLEASE: check your contribution thoroughly for errors and ensure you have adhered to these simple procedures before you send it.

To discuss your ideas: ☎ *moving home, so not yet known* 💻 pteridologist@ebps.org.uk (or write a letter)

PTERIDOLOGIST 2004

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COVER PICTURE: Hard shield fern *Polystichum aculeatum*, one of the subjects of our **Identification** section (see page 76).

Unless stated otherwise, photographs were supplied by the authors of the articles in which they appear.

DISCLAIMER Views expressed by contributors to *Pteridologist* are not necessarily those of the **British Pteridological Society**.

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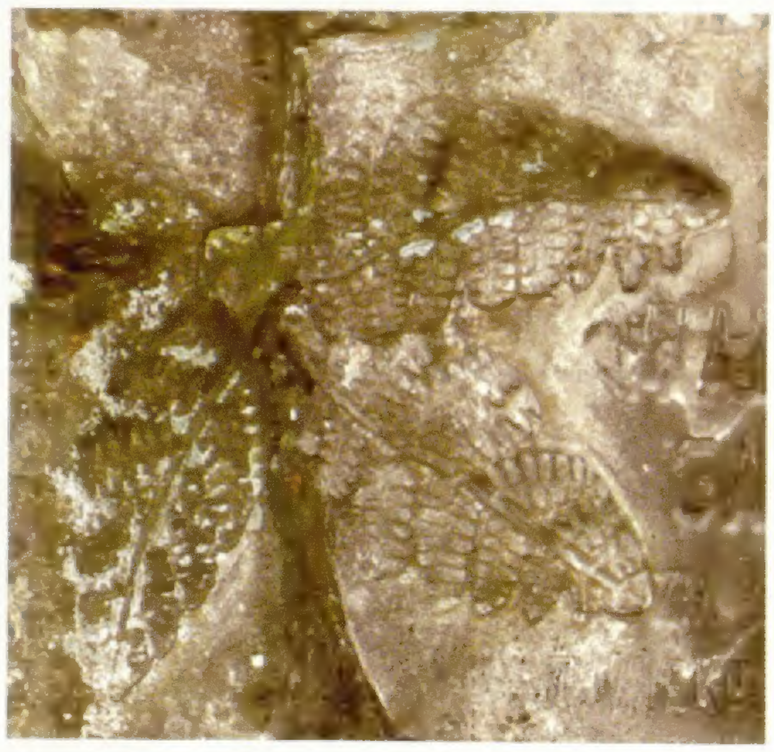
✉ GRAVEYARD FERNS IN POLAND AND LITHUANIA ✉

Being enchanted by the new get-up of the Fern Magazine I would like to contribute some pictures towards the next issue of *Pteridologist*.

As you might know it is not so easy to find representation of fern fronds carved in sandstone or marble.

When I was visiting old cemeteries I found two interesting tombstones: first at Sandomierz (a small town in the south-east part of Poland) and second in Vilno (a famous Polish cemetery "The Rossa" in the capital of Lithuania).



Tombstone in Sandomierz, Poland

Tombstone in Vilno, Lithuania

Elzbieta Zenkteler
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Instytut Biologii Eksperymentalnej,
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POLAND

NEWS & COMMENT

LETTERS

EARLY FERNING

Many moons ago, whilst an undergraduate at the University of York, I did my third year project on possible subspecies of Bracken. This of course turned out to be a can-o-worms but little did I know at the time. To this end, during the summer of 1988, I took my two daughters on a so-called holiday to Arran where we trailed around looking at bracken sites. In fact we had a very nice time, staying at the charming youth hostel at Lochranza.

Later that summer my youngest daughter Amy (then 8 years old) went on a summer camp to the Forest of Dean. One evening I had a very excited phone call from Amy exclaiming: "Mummy, mummy I'm having a great time and I've found 7 different species of bracken and I've pressed them all in newspaper for you". Well this was a very exciting prospect indeed. When she returned I opened the newspaper with great anticipation and trembling hands. In the package I found seven crumpled fronds. One was indeed bracken but there was also one each of lady fern, male fern and broad buckler fern. The other fronds looked to be 3 distinct forms of *Dryopteris affinis*.

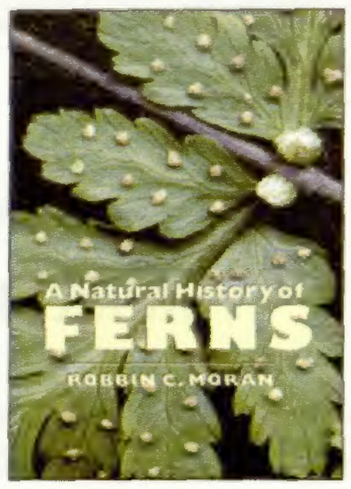
I gave her 10/10 for observation and a Mars Bar but decided to keep quiet. Amy is now something in the theatre and I work on the behaviour of hoverflies!

Yvonne Golding
yvonne.c.golding@man.ac.uk

SNOW DAMAGE

This year I noticed that a magnificent plant of *Blechnum chilense* in Attadale Gardens (see page 88) looked much rougher than usual in spring. Every stipe was bent and twisted at or just below the insertion of the lowest pair of pinnae. The reason was sheer weight of snow which lay over 6 inches thick for a couple of weeks at the end of February. The remedy? I had been greatly amused by one of the Attadale gardeners who I saw take a broom to the flat sprays of a cedar, sweeping the snow away. I had presumed he was engaged on pointless, low-season work creation, but soon learned that snow can seriously damage good trees, so it's a very necessary job in a show garden. I was assured by the head gardener that the same process will be applied to ferns next winter if necessary.

James Merryweather



A NATURAL HISTORY OF FERNS

by

Robbin C. Moran

This new book will be published in September. It is a non-technical work, about 300 pages long with 145 line drawings or photos and 26 colour plates. There are 33 chapters, grouped into six general categories: Life cycle, classification, fossil ferns, fern geography, adaptations, and ferns and people. It is not a field guide, but explains how ferns grow and develop, disperse and reproduce, adapt and evolve. In short, what ferns are doing out there in nature. Robbin writes exceptionally well (see *Pteridologist* 3:1, 1996) and this book should interest all members of BPS.

FERNS DIVERSIFIED IN THE SHADOW OF ANGIOSPERMS

It is not often that ferns make the hallowed pages of the leading scientific journal *Nature*, but in the April issue a group of scientists from America, Mexico and Germany report a new phylogenetic analysis of ferns. It is based on molecular data, with constraints from a reassessment of the fossil record. They suggest that a full understanding of fern diversification and evolution using only palaeo-botanical evidence is problematic because of the poor taxonomic resolution of the fern fossil record in the Cretaceous. Past theories have suggested that the rise of the angiosperms during the Cretaceous led to a decline in fern diversity and abundance. This new work reports that polypod ferns, which represent more than 80% of living fern species, diversified in the Cretaceous, after angiosperms, suggesting that this may represent an ecological opportunistic response to the diversification of angiosperms and their subsequent domination of terrestrial ecosystems.

To read more see:

***Nature* 428:1 April, 2004**
<www.nature.com/nature>

Yvonne Golding

NEWS & COMMENT

Woodsia ilvensis

RE-INTRODUCTION PROGRAMME

Heather McHaffie
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Edinburgh EH3 5LR

Many people will be aware that attempts have been made by the Royal Botanic Garden Edinburgh to re-introduce *Woodsia ilvensis* into several secret sites. As a UK Biodiversity Action Plan species *W. ilvensis* is of great conservation concern as there are now fewer than 100 clumps in Britain. As a last-ditch attempt to encourage regeneration three re-introductions have been made. In 2003 I visited the re-introduction localities, one near Moffat, the other two close together in Teesdale. After an exceptionally warm summer it was thought that the plants might have been suffering, especially as dryness is a possible cause for decline of the existing plants. On successive visits it was noticeable that the Border hills all around the old *Woodsia* localities still managed to produce some very wet days, and the weather in the hills was very different from that nearer the coast. Cloud on the hill is probably an important part of their habitat.

The Moffat re-introduction, made in September 1999, is in a steep-sided gully with approximately north and south-facing sides. The plants on the south-facing side were planted into rock crevices or on ledges. This is an especially difficult habitat to plant successfully. The north-facing plants were mostly planted into scree. A few were deliberately planted high up using a ladder, in the hope that they would not attract grazing animals, but these were not monitored. Of the 115 accessible original plants, 75 were still alive after four years. This survival rate of 65% is comparatively high for a re-introduction (P. Lusby, pers. comm.). A few plants were very small, with fronds as little as 1.5 cm long, and they might not survive, although the dry summer had been a good test. One plant that had been found in the 2002 monitoring had a beautiful bird's nest, possibly a grey wagtail's, built over it, and the fern appeared to have succumbed. Some of the most robust were growing on scree where there was little sign of grazing despite the local goat population. Many of the existing wild plants elsewhere in Britain are in cracks on rock faces, but it might be grazing that has led to this apparent preference as the scree plants were growing so well. Norwegian *Woodsias* frequently grow on screes (Adrian Dyer, pers. comm.) and this might be nearer to the preferred habitat. All the plants that were re-introduced were derived from locally produced spores from both of the nearest wild populations - consisting of two plants and one plant, not very large populations! It is because the original populations had declined to so few plants that a re-introduction was felt to be appropriate.

The Teesdale re-introductions are at two sites with a southern and northern aspect. The south-facing population was planted in 1999, mainly into rock crevices but some plants were put into a block scree at the base. Seven out of 28 plants (25%) survived in the crevices, while 19 out of 35 plants (54%) survived in the mossy scree. Some of the scree plants were in the middle of what appeared to be vole runs and they did not seem to appreciate the volume of traffic. These survival rates are still very satisfactory. At the north-facing scree planted in 2000, 48 out of 50 plants had survived - an amazingly high success rate. As at the Moffat site, some were extremely small, but most of the plants were fertile. This population is frequented by local rabbits who did a limited amount of nibbling, but understandably trampled some plants that were on their regular routes.

As there were no Teesdale plants left and the nearest locations were Wales or the Lake District, there had been some discussion on the source of the re-introduction plants. Most of the existing populations elsewhere have very few plants and there is always the concern that such populations suffer from inbreeding depression. It was therefore decided that the Teesdale re-introductions would be made up of plants grown from spores representing all of the surviving British populations. It is difficult to make comparisons between the successes of plants from different provenances as each planting position has its own unique conditions and there is no clear indication from the monitoring data of the relative success of plants from the different populations.

A new re-introduction was started in autumn 2003 at another site in the Borders north of Moffat. The Carrifran Wildwood project is an exciting scheme that plans to reforest a whole catchment area. Using local seed, where possible, trees are being planted in appropriate groups to span from the river bank right up to montane willows. Above this level was a site from which *W. ilvensis* was repeatedly collected and has now long since gone. Two rope surveys on the cliffs failed to find any more plants so the first phase of *Woodsia* planting commenced in the autumn of 2003. In the spring we will also try placing gametophytes into crevices, which might be a better option than trying to insert sporophytes.

There is no sign as yet of regeneration in any of the re-introductions. Survival of the sporophytes is only the first step towards the regeneration of a self-sustaining population which is the only meaningful goal. There will now be considerably more spores released into the environment raising the chances of new sporophytes. It might be that only a series of exceptionally wet years favour the establishment of new plants. We are still far from identifying the precise conditions necessary for regeneration.

Until recently all the work with these plants was done by Stuart Lindsay, Adrian Dyer, Phil Lusby and Andrew Ensoll. My thanks for all their hard work. The project is now part of my remit as Conservation Officer for Vascular Plants. Phil Lusby continues to help with the monitoring and Andrew Ensoll lovingly cares for the conservation collection held here at the Royal Botanic Garden, Edinburgh which represents most of the genetic variation in the British populations.

NEWS & COMMENT

Lophosoria on Arran

Alastair C. Wardlaw, 92 Drymen Road, Bearsden, Glasgow G61 2SY

***Lophosoria quadripinnata* in Brodick Castle Garden on the Island of Arran**

Showing the 2-metre stipes and triangular blades with silvery-blue undersides, swaying in the wind despite being surrounded by a shelter belt of trees and shrubs.

One of the many pteridological treasures on the Island of Arran in the Clyde Estuary is *Lophosoria quadripinnata* growing in the woodland garden of Brodick Castle (National Trust for Scotland).

According to one of the gardeners to whom I spoke during a visit in mid-March 2004, the plant has been there for at least 12 years. It is not shown on any plan of the garden, nor do the clumps of *Lophosoria* have a label. However, it can be located from its close proximity to a rustic cottage in the woodland, signposted as the Bavarian Summer House. Beside the main path, about 10 paces from the doorway of the Summer House, is a collection of mostly exotic ferns amongst which the *Lophosoria* has pride of place. The other species, some of which were labelled, included *Blechnum chilense*, *Blechnum penna-marina*, *Dicksonia antarctica*, *Matteuccia struthiopteris*, *Microsorum diversifolium*, and *Woodwardia orientalis*.

The *Lophosoria* had survived the recent winter well without frond withering, despite the garden having had a -9 °C frost, considerably colder than the average of about -5 °C. However, it was the gardener's opinion that the sheltered areas within the woodland might not experience such low temperatures. Certainly, the numerous large *D. antarctica* tree ferns throughout the woodland had mainly green fronds, as did the many smaller, untrunked plants of this species which had become established from spores that had settled in damp places.

I estimated that the longest stipes on the *Lophosoria* must have been close to 2 m, to which the triangular, quadripinnate blades added another 70-100 cm. So it was a really large and impressive fern! A few of the fronds had small, circular sori, located on veinlets away from the blade margins. The sori lacked indusia but had 'wigs' of abundant paraphyses.

Croziers of *Lophosoria quadripinnata* at Brodick in mid-March 2004.

These features are characteristic of *Lophosoria* and separate it from e.g. *Pteridium*, *Thyrsopteris* and *Culcita*. The croziers and stipe bases were covered with a mat of light-brown hairs, which had mostly disappeared from the mature fronds. The four clumps of the plant at Brodick had in the order of 50 fronds altogether, some getting on for 3 m and others only about 50 cm. The rhizomes, to the extent that they were visible, were short and prostrate with no evidence of a trunk.

L. quadripinnata is the only species within the genus, which in turn is the only genus in the Lophosoriaceae. Taxonomically, it is considered to have some affinity to tree ferns of the genus *Cyathea*. It is widely-distributed in Central and South America, from Mexico southwards to Argentina, Chile and the Juan Fernandez Islands. Apparently a very variable species, *L. quadripinnata* is described by Martin Rickard in his *The Plantfinder's Guide to Garden Ferns* as "a beautiful, potentially dramatic fern that deserves to be more widely grown".

Only one supplier is listed in the *RHS Plant Finder 2003-04*. Spores have not been offered by the BPS Spore Exchange in recent years.

Several plants of *Lophosoria* have been growing outside for a few years at Logan Botanic Garden, near Stranraer. I hope these notes may stimulate other BPS members to write in about this species being successfully cultivated out of doors elsewhere in Britain.

IN THE GARDEN

FERNS IN MY GARDEN - *Asplenium scolopendrium*

Jack Bouckley, 209 Woodfield Road, Harrogate HG1 4JE

My interest in 'scollies' (*Asplenium scolopendrium* or *A.s.*) started around the early 1980s when I was in the garden of a well-known plantsman who, apart from many flowering plants, also grew a few very choice ferns, one of which was a really beautiful specimen of *A.s.* 'Crispum'. Up until then I had never seen this particular variety and I expressed my admiration of it.

Without further conversation, he took his spade and dug up a smaller, but otherwise identical plant, which he presented to me. I later found that it was the very special 'Crispum Bolton's Nobile' (*below*).

PHOTO: AZU FLETCHER

This addition encouraged me to look for more and the results of my search have been very rewarding. For example, while on a field study weekend, I spotted a wild hart's tongue with the features of *A.s.* 'Ramosum-transversum' growing on a ledge in a gully. The farmer who was showing me around shinned up the cliff side, told me that there were three of these plants and asked if I would like one. I could hardly say no, and he promptly peeled one from the surface of the rocky ledge where it was rooted in accumulated debris. Though planted immediately in my garden, all was not well. The ramose-transverse form lasted for but one season and then reverted to the simpler ramose form. After two more seasons it became the wild type and remained like that for another three or four years until 2002, when again a slightly ramose effect was showing on the fronds. This forking was visible in 2003, so it might be ramose-transverse again in a year or two.

A rather nice 'Crispum' in my collection, not as good as the one mentioned above has, over about ten years gradually reverted to quite a tatty looking undulate form, and a marginate form which I got from Reginald Kaye has on more than one occasion produced two and even three varieties of frond. Does this phenomenon only affect scollies or does it happen to other ferns, such as *Polystichum* varieties?

In 2002 the *A.s.* mentioned in paragraph one decided to produce a frond which was wider that those on the parent plant and very nicely variegated. In 2003, it produced a crown with all of the fronds showing these same features, so all being well, next season I will remove this crown and hopefully a few more plants will be forthcoming.

Some time ago I was given a plant wrongly named *A.s.* 'Verco', which later turned out to be to be *A.s.* 'Verrucosum', which has a very warty frond upper surface with undulate edging. It is quite a nice plant, so I decided to try an experiment with the spores which it produced in small numbers. I also collected some spores of *A.s.* 'Crispum Moly'. With the aid of my microscope I sorted out a very small quantity of spores of each and planted them together in the old fashioned way on sterilised compost, in a pot kept in a plastic bag. Eventually eight prothalli appeared, luckily all quite close together. After a few weeks the sporophytes began to appear. I sprayed when necessary with tepid water until, after a few weeks it became quite apparent that one of the new plants was not 'Moly' nor the 'Verrucosum' but something which had the warty upper frond PLUS a very crisped frond edge PLUS, as a surprising bonus, a corkscrew ending to most of the fronds (*below*).

PHOTO: AZU FLETCHER

This plant is now three years old and it shows no sign of reverting to either parental form, but unfortunately it has not followed 'Moly' in its ability to produce spores on a crisped frond. Next season, when there is some new growth on this plant I will see if a friend of mine will have a go at producing more of this fern by micropropagation. At the same time I will try the old method of frond base culture with which I know some BPS members have been successful.

I am quite happy with the way the plants are performing but one surprising thing is the number of natural scollies which have grown in different places round the garden, such as at the bottom of a wall, on a lump of tufa and, unusually, one is among some moss on a piece of gritstone.

TWO CHEERS FOR BRACKEN

Martin Spray
Hillside, Aston Bridge Road, The Pludds, Ruardean, Glos. GL17 9TZ

PHOTO: JAMES MERRYWEATHER

"Bracken, bracken, oh why all this bracken?"

A PLANT OF SOME VALUE

"Bracken, bracken, oh why all this bracken?" bemoaned George Stapledon in the 1930s. Two centuries earlier, a dozen commoners of Gilthwaite Moor in Yorkshire were worried about infringements of their rights to the fern and, considering themselves "injured therein by this cutting downe burning & takeing away the said Bracken do hereby … agree … to stand by and assist each other in the defence of … our right to common upon the said moor…."[1]

Not always and everywhere has *Pteridium* been considered a major problem. In a recent *Pteridologist*, John Grue notes from the French Pyrenees a reviving example of the role of *la fougère*.[2] As is well known, in the past it was used in many ways, and has long had a place in rural economy. There are even claims it was planted on some Scottish islands.[3] Being rich in potash, it has been valuable as a means of improving soil fertility and in glass and soap manufacture. The Gilthwaite felons were probably making washing soda. In many areas it has served as animal and human bedding, and as fuel. There is renewed interest in biofuels, but we still await the handy bracken briquette.[4] Before pneumatic tyres, it was much valued for packing goods, and before it was linked with cancer one might be tempted to cook crooks "... so young they snap off … They have a distinctive smoky flavour - rather like the smell of Darjeeling tea. Brown bread and butter is the best accompaniment."[5] Bracken has even been made into silage - eaten keenly, apparently.[6] The plant is normally shunned by stock, although there are, for instance, about 20 fatal poisonings amongst cattle each year.[7] Despite this ambivalence, in several small ways, bracken still serves as a useful resource in the British countryside, especially for gardeners. This article describes one family's use of the plant in the Forest of Dean, Gloucestershire.

'Fern' grows abundantly in much of the Forest. It is characteristic of 'forest waste' - unplanted areas - especially where the traditional free-ranging sheep had limited access. Since the foot & mouth disease farce in 2001, when all Forest sheep were killed, some of these areas in the villages, and road verges, have been mown, because of rapidly spreading fern (and brambles). We have about half a millionth of the U.K's 'crop' of it (estimated at 975,000 ha) on a steep bank. In 1968 this was still useful grazing land; when we moved here in 1989 it was becoming wall-to-wall bracken. In our first three years here, part of the bank was

repeatedly cut over by sickle. This patch is now developing as self-sown woodland - with bracken in the understorey. Although we have had no excuse for making the pig swill noted in the Forest in the 1840s,[8] we have found several uses for bracken in the garden at Hillside.

We are not unaware of the health question, but think we handle the plant sensibly. Bracken hereabouts hasn't spored while we have lived here.

MULCH

We have few tender plants to blanket with dead bracken against frost - still a frequent practice amongst British gardeners. Considerable amounts, however, collected as needed from late autumn to early spring, are used as mulch. This gives us fair company: it's been so employed at Wakehurst Place, for example, and Wisley, and on many a nursery. This has three main purposes: to suppress, and to limit germination of, weeds; to conserve soil water; and to reduce winter leaching and compaction. The local soil, from sandstone, is a 'hungry' one, retaining little humus, and thus frequently short of water. A further use of the mulch is as bulk organic matter - another long history. Renewed interest in using bracken is mainly amongst *organic* gardeners.[9] I have not tried burning the fronds and using the ash; but Maud (Mrs.) Grieve, writing about 1930, thought that "in the present scarcity of fertilizers, the high potash content of the ash is well worth investigating", and a yield of a ton from 4 acres has been estimated.[10]

Fronds cut after senescence and before winter collapse are available year after year, are easily bundled and can be carried by pitch-fork. They make a loose mulch, which is useful for about a year on cultivated soil, after which it can be dug in. On undisturbed soil, it is effective for twice as long, sometimes more. Although it can easily be made deep, it allows too much light to penetrate for total weed suppression. It is, for instance, of little use against creeping buttercup or stinging nettle.

Rather more effective are the collapsed and softened fronds, picked off the ground in winter or early spring - by when, some research suggests, carcinogen danger has gone.[11] This material, of course, is heavier, and best barrowed. Laid in the garden it consolidates into a blanket maybe 5-10 cm thick, sufficient to inhibit most new weed germinations and suppress many established plants (buttercup, alas, only partly). It will also, laid on damp soil, usually keep the soil surface moist throughout summer. It works well on potato beds. Most tubers are formed just below the mulch. Several organic gardening writers advocate its use thus, sometimes claiming it inhibits scab and - optimistically! - slugs.[12] A disadvantage of this frondy mulch is that when removing weeds or putting in new plants one tends to disturb too much of it.

Better in that respect, and most efficient as mulch, is part-rotted litter - the material that accumulates in a bracken stand, slowly decaying, above the soil proper. On the bank this is typically 3-8 cm thick, under maybe twice that of last year's fronds: a natural mulch, which, with the shade cast by the fronds, and - possibly - allelopathy[13], makes for a highly competitive plant. If it is allelopathic, and - even slightly - slug repellent, it might have a bright future in organic gardening and farming.[14] We have many oak and sweet chestnut, and some other tree seeds germinate in this litter on the bank each year, but very few manage to establish. Even with the litter raked off, establishment is poor, unless over shading new fronds are kept at bay for several years. This also allows an understorey of grass to develop - and brambles to invade.

This litter, paler than freshly dead fronds, is mostly in pencil-length or shorter pieces after a couple of years. Once the current or past year's growth is removed, it is easily raked loose, and barrowed to the garden. Alternatively, newly dead fronds are cut in autumn and stacked for two to three years, by when they have decayed to the right state for use as a close-knitting, hard-wearing, weed-resisting blanket. Litter is fairly easy to weed, plant or harvest through, and gaps are easily patched. It is, in addition, a quite attractive material, clean and easily removed, and useful as a rough and ready 'decorative mulch'.

Woodland edge part of garden, formerly a barrow route, one year after 'repairing' with dead bracken.

Between litter and the mineral soil on the bank, a layer of loose-fibrous 'bracken peat' tends to form, about 2 or 3 cm thick and full of bracken roots; it can be much thicker under old colonies. I have found little reference to the material, or to its use.[15] Occasionally, I have used it to 'top off' pots of bulbs. It looks rather too 'chunky' to use as mulch - and takes

much more effort to collect than the litter. It *might* be worth investigating.

All these mulches, but especially the intact fronds - because they are more readily lifted off afterwards - have the additional benefits of reducing the leaching of nutrients out of the topsoil, and of allowing some walking over the ground without severe compaction. An extra-thick layer makes a temporary pathway. That said, straw and hay seem to work better.

Onion and potato beds, and newly made path: bracken paving meets old carpet strips.

PATH SURFACING

This leads to a bright idea. Because the litter is hardwearing, I use it in parts of the garden as a path surface, and it provides a pleasant, 'informal' appearance and feel. One particular short path, used hundreds of times a year, often with laden barrows, was 'paved' directly onto compacted soil, with about 7-10 cm of raw litter (*above*). It remained intact and largely weed free for two years, when it needed 'resurfacing' with another 2 to 3 cm of litter. It has subsequently needed rather more weeding, because of soil dropped on the surface, and partial patching every other year. It succeeds in the attempt to maintain an unobtrusive path through a lightly shaded naturalistic part of the garden. I admit that in other parts, where more soil is spilled onto the bracken, it is best to remake the path every two years or so.

A word of caution here: it is fine on level and slightly sloping ground, but dry bracken litter on a steeper incline is more of a slide than a path - as our daughters reminded me, it is toboggan-friendly!

Two other comments on bracken mulch and compost: commercial interest in compost made from this source is growing[16], but is still insignificant.

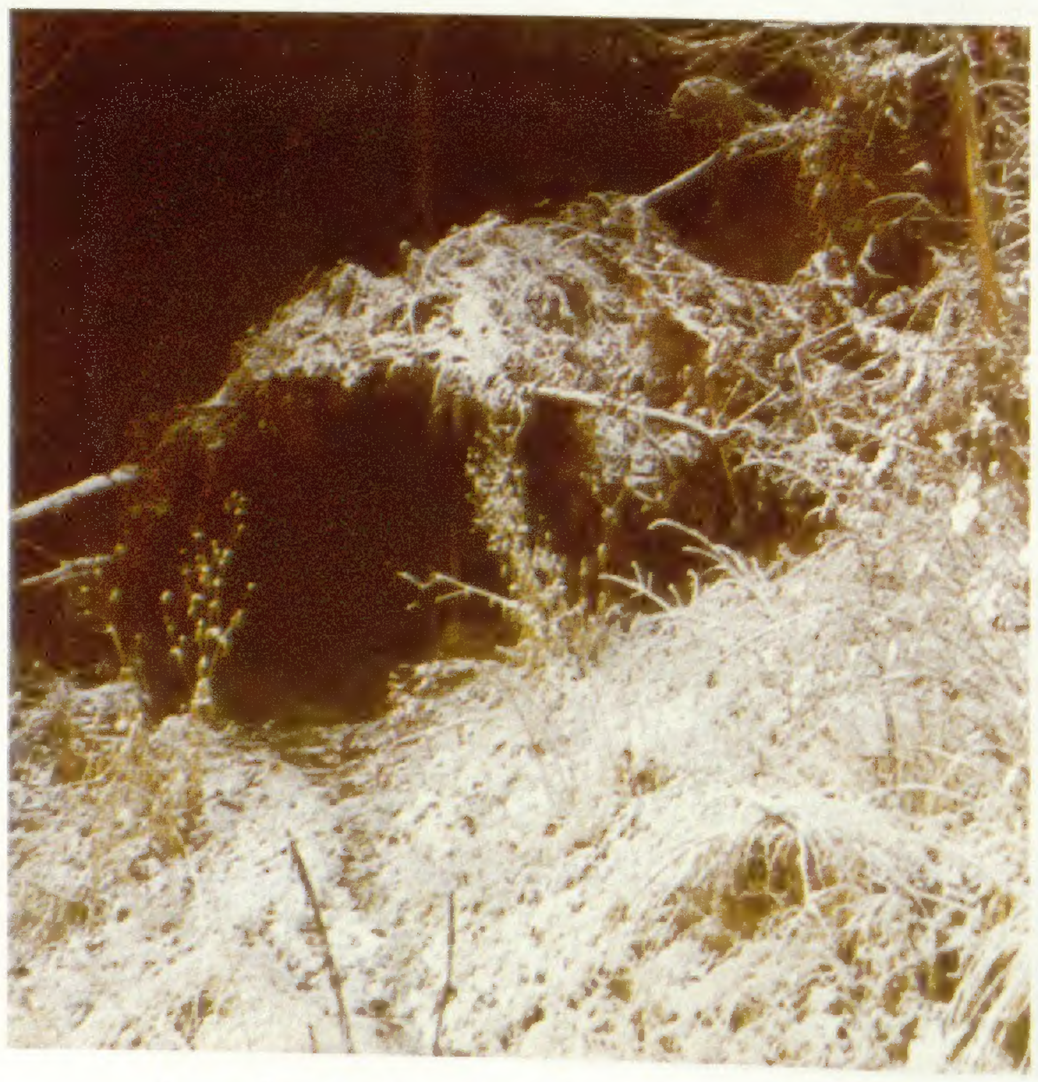
Considering its history, and its potash richness, especially if cut in June or July, this is disappointing. In the eighteenth century, at least one "very curious Gentleman in Gardening" made very good hot beds of it. This is in Philip Miller's famous *Gardeners Dictionary*,[17] under 'Manure'. I cannot resist quoting *en passant* his comment under the heading 'Filices': "Fern. There are great Varieties of this Plant in different Parts of the World, but particularly in *America*; but as they are Plants which are seldom propagated in Gardens, I shall pass them over in this Place".

I have no experience of the use of green-cut fronds, except for mulching occasionally with part-decayed material that had been stacked for one or two years. Despite my earlier comment, some research suggests that even heated to 60 °C, it should be left for 4-6 months.[18] It is then relatively quickly incorporated. So is the soiled bedding from the donkey's shed..

ANIMAL BEDDING

Dung and urine enriched bedding has historically - and presumably prehistorically - been an important agricultural resource.[19]

This is one use of dry dead bracken outside the garden. Richard Mabey comments that it is the 'natural' - and often free - animal bedding that has "fallen furthest from popularity".[20] An earlier enthusiast had urged: "where bracken can be obtained its use … is a matter deserving serious consideration. It suits the animals, though not so well as straw".[21] A dozen bundles, tied with binder twine, as big as can be carried comfortably, are sufficient for a winter for a donkey and its companion sheep. The only disadvantage seems to be the relatively large volume required to store it. When soiled, it is stacked outside, and later used in the garden in the traditional way - as 'top dressing' *cum* mulch.



A rude shelter in the shade garden in the forest near the end of its life.

In at least one part of Britain, one can still see large, round, brown bales of bracken: in the Brecon Beacons, several farmers

- mostly commoners, who like those of Gilthwaite are protective of their resource - continue to bed their cattle on fern.[22] How much bracken is still harvested in Britain as stock litter, and at what scale, I do not know. People are generally surprised that we use it for this purpose. I would note that it does not make the most comfortable mattress for *human* use, being sharp angled, and rather noisy - though, again, it is traditional… and apparently gorillas like it.[23]

BRACKEN AS THATCH

The final use to which we have so far put this plant is as thatch. As one might imagine, it has a long history of use thus. I have not come across any buildings roofed with it; but there are some fine examples around, judging by the pictures.[24] Some thatchers promote it; and it is said that a well-made thatch of fern should work for 15 to 20 or even 30 years.[25]

My own inexpert examples had shorter lives. These were small, man-high, play 'dens', and a badger-watching hide. Each had a curved form, made with frames of branches, with smaller, twiggy, branches woven into them. Over this was laid senescent and dead bracken, about 10-15 cm thick, working upwards from the ground, and laying the final fronds across the top. The dens had crawl-in entrances (they *were* for play!), and could seat 5 or 6 people. They remained 'dry' inside, except in very rainy periods when they were never much more than damp. Another den, occasionally slept in winter, had a 'cheat' layer of polythene over the frame, with more branches on top of it for the bracken to lodge into. This was used, with minor repairs to the thatch, for five years. The others were 'decommissioned' after two, but could have been quickly rethatched. Two years is as long as two other structures lasted, elsewhere in the woods: 'Bracken Ring' and 'Bracken Knot' were temporary contributions to the Forest of Dean Sculpture Trail by Stuart Frost.[26]

FOR THE FUTURE

I have to admit I've not explored how useful the products of bracken are specifically for the fern enthusiast. However, it may be worth commenting that, in ten years, I have noted only a handful of young ferns on the paths, and these were, I think, *Dryopteris dilatata*. The 'fernery' itself receives an annual leaf-fall, mainly of oak, and the ground was initially deeply mulched with leaf mould. Only a small quantity of old litter has been used, on one part of the path. I do not grow *Pteridium* there.

In fact, it is strangely tricky to cultivate. But there is more than enough of it wild! Despite its welcome usefulness (and cheapness), its seasonal beauty, and its nature conservation value[27] (I frequently find slow-worms in composting piles), despite the enthusiasm of *some* fellow gardeners[28], despite - even - being told that it is "the best custodian of unused and misused land … one of the greatest producers of fertility on our planet"[29] (and there is evidence that it can increase soil fertility[30]), we would be pleased to have a little less . . . . . **BRACKEN**

NOTES

(*Two Cheers for Bracken*)

1 This example of a court record, dated 30 January 1726, is from the Sheffield City Archives, Bagshaw Coll. 878 nr. 1

2 Grue J (2002). Bracken in traditional animal husbandry. *Pteridologist* 4[1], 4.

3 Esp. Rymer L (1976). The history and ethnobotany of bracken. *Botanical Journal of the Linnean Society* 73, 151-76. Also e.g. Page CN [1988] *A natural history of Britain's ferns* Collins, London; and for current usage Mabey R [1996] *Flora Britannica* Sinclair-Stevenson, London. A useful North American summary is at <www.fs.fed.us/database/feis/plants/fern/pteaqu/value_and_use.html. Planting is noted at <www.roundandabout-mull.co.uk>

4 Lawson GJ, Callaghan TV & Scott R (1986). Bracken as an energy source. in Smith RT & Lawton JA eds *Bracken. Ecology, land use and control technology*. Parthenon, Carnforth Lancs.

5 Hartley D (1954). *Food in England.* Macdonald & Jane's, London.

6 Aitken AP (1888). Stack silage made from brackens. *Transactions of the Highlands Society of Scotland* Ser. iv 20, 209-13.

7 Hopkins A (1995). Factors influencing cattle bracken poisoning in Great Britain. in Smith RT & Taylor JA eds *Bracken: An environmental issue.* International Bracken Group Special Publication no. 2.

8 Quoted in Rymer (note 2).

9 e.g. Gethin R (1991). Bracken: friend or foe? *Organic Gardening* 4[12], 28-30; Schnabel J (1990). The triffid bracken. *Henry Doubleday Research Association Newsletter* nr. 119, 31-2; Bracken fern - it is not so bad after all! at <www.backyardorganicgardening.com> See also notes12, 14 & 16.

10 Grieve M (1931). *A modern herbal.* Cape, London; repr. 1994 Tiger Books International, London; Faust K [2002] The ethnobotany of bracken fern and implications for use in the Yucatan Peninsula [*Ethnobotany* 170] available at <www.maya.ucr.edu/pril/ethnobotany/image/Pteridium.pdf>

11 Potter DM & Pitman R (1995). The extraction and characterisation of carcinogens from bracken and the effect of composting. in Smith & Taylor (note 7), 110-5.

12 Easey B (1976). *Practical organic gardening* Faber, London.

13 Allelopathy is natural 'Chemical warfare'. Plants, including bracken, are able to inhibit the growth of potentially competitive neighbours with compounds washed out of fronds and residual in litter. See: den Ouden J (1995). Allelopathy in bracken in the Netherlands. in Smith & Taylor (note 7), 43-6; Gliessman SR (1976). Allelopathy in a broad spectrum of environments as illustrated by bracken. *Botanical Journal of the Linnean Society* 73, 93-104; Verónica Nava R, Edda Fernández L & Silvia del Amo R (1987). Allelopathic effects of green fronds of *Pteridium aquilinum* on cultivated plants, weeds, phytopathogenic fungi and bacteria. *Agriculture, Ecosystems & Environment* 18, 357-79.

IN THE GARDEN

14 Donnelly E, Robertson J & Robinson D (2002). Potential and historical uses for bracken *[Pteridium aquilinum* [L.] Kuhn] in organic agriculture. In Powell *et al.* eds *UK organic research* 2002, 255-56, available at <www.organic.aber.ac.uk>; see also:
<www.sac.ac.uk/cropsci/external/orgserve/EricMSc.htm>
<www.abdn.ac.uk/~soi456/aucoa/bracken.htm.>

15 The references I had, I've lost. Any information welcome.

16 Milliken W & Bridgewater S (2001). *Flora Celtica. Sustainable development of Scottish plants*. Scottish Executive Central Research Unit, Edinburgh, and <www.scotland.gov.uk/cru/kd01/orange/sdsp.00.asp>; Pitman R (1995). Bracken compost: a substitute for peat? in Smith & Taylor (note 7), 191-6; Pitman R & Webber J (1998). Bracken as a peat alternative. *Forestry Authority Practice* Note, Forestry Commission, Edinburgh, and <www.forestry.gov.uk>.

17 Miller P (1759). *The gardener's dictionary*. 3rd ed. London.

18 Pitman [read 16].

19 Russell EJ (1908). On the use of bracken as litter *Journal of the Board of Agriculture* 15[7], 841-7.

20 Mabey R (1977). *Plants with a purpose*. Collins, London.

21 Russell, note 19.

22 Davies J (2003). personal communication; Brecon Beacons National Park farming advisor. Mabey (note 2) names only the "Welsh Borders" in this regard.

23 Noted in Faust [read 10].

24 The Roundhouse Project <www.theroundhouse.org>

25 Rymer, note 2; <www.thatching.net>

26 Martin R (1990). *The sculpted forest*. Redcliffe, Bristol.

27 e.g. Pakeman RJ & Marrs RH (1992). The conservation of bracken *[Pteridium aquilinum* [L.] Kuhn]-dominated communities in the U.K., and an assessment of the ecological impact of bracken expansion or its removal *Biological Conservation* 62, 101-14; Senior Technical Officer's Group, Wales (1988). *Bracken in Wales* Cyngor Gwarchod Natur, Bangor; Thomas RW (1995). Bracken management in the Peak District - a local code of practice in Smith & Taylor (note 7), 182-90.

28 Dutton G (1994). In praise of bracken *The Garden*. December 578-9.

29 Haworth-Booth M (1961) The flowering shrub garden today. *Country Life*, London.

30 Marrs RH, Lowday JE, Jarvis L, Gough MW & Rowland AP (1992). Control of bracken and the restoration of heathland. IV. Effects of bracken control and heathland restoration treatments on nutrient distribution and soil chemistry. *Journal of applied Ecology* 29[1], 218-25.

HAVE YOUR SAY

BPS PUBLICATIONS: HAVE YOUR SAY *continued*

ABOUT PTERIDOLOGIST

Production of *Pteridologist* is an evolutionary process. Lessons are learned *en route* or by hard criticism, and new ideas constantly arise, which stimulate minor creative changes to incorporate within the basic design framework. As editor and designer I am constantly learning and I expect to continue learning indefinitely.

It has become evident to the BPS publications sub-committee that articles which report original research might be better suited to *The Fern Gazette*, so the promised one about Bradbury's nature prints of 1854 has already been transferred. Others are too long, too detailed or too verbose. Too many pages per article have been used and print in them and others has had to be made smaller and tighter than is desirable. Pictures - one reason we now have full colour - are often too small to express what they might do really well if given a fair amount of page space. Indeed, pictures can tell much of a story painlessly if they are good enough and well presented, whilst complemented by well written text.

The appearance of several of last year's articles changed dramatically during preparation. My sternest critic (who is also my staunchest supporter) metaphorically stood at my shoulder as I removed unnecessary pictures, and cropped and enlarged the rest to make room for the text and show off the photographic subjects to best effect. With the authors' consent, texts were abbreviated so that readers only got what we felt they would want to read in a more visually acceptable form, and eventually it all fitted neatly onto whole pages as well. My designs were vastly improved, but - and I don't blame anybody else, because it's my work - I find some of the finished pages dissatisfyingly 'rectangular' and, to my mind, they still look a bit amateurish. A lot more can be done.

If you examine my history as designer of *Pteridologist* you will find that when we first introduced colour in 1996 the pages were open and airy compared with the next edition when I came under pressure to save money and not 'waste space'. Since I returned to redesign the magazine in 2002 that density of text has had to be retained and, in my opinion, we haven't produced a modern, professional-looking publication - yet. Too much of the page is still covered with small words with tight line spacing and, although you get plenty of information for your money, I think that is at the expense of reader comfort and pleasure. If we ask you - and that is the intention of this article - we will certainly find that opinion is divided, but we don't know to what extent. If you have them, please compare the 1996 and 1997 editions and, forgetting about content, decide which you prefer to read. Next, with that in mind, look at the 2002, 2003 and 2004 editions and then let me know about style improvements you think might enhance *Pteridologist* 2005 for you. I will only know if you say.

Pteridologist now has an editorial team and this kindly editor, whose red pen is often relatively ineffective, will relinquish his influence in major text revision. A more structured editing system will soon be in place, ready to receive submissions for the next edition as soon as you care to send them. You may wish to send us a pre-submission, draft version so that author and editors may discuss its eventual format together. Of course, editorial changes will be communicated to authors for approval. If you feel you have too much to say, please ask us anyway. If all of your words really matter, we can still decide to include the complete article.

Please write to me by post or e-mail and voice your opinions. I hope that *Pteridologist* will continue to improve, incorporating suggestions from its readers.

James Ed.

VICTORIAN POEMS

This poem is printed after the preface of H.C. Baildon's folio Nature Printed Ferns (London, L. Reeve, 1869). It is untitled but obviously about ferns even if the title of the book hadn't told us. Only initials (HBB) of the author are given but H.C. Baildon had a son Henry Bellyse Baildon (b. 1849) who graduated in English and then became an author and lecturer in English language and literature after a spell with his father's pharmacy business in Edinburgh. Perhaps he was also known as a poet of sorts.

Ye dwellers on the moorlands,
In woods, by joyous streams,
Curling to kiss the water
That flowing silver seems;
In shady glens ye gather,
With plumage tapering tall;
With graceful-drooping tresses
Ye deck the ruined wall.

Ye raise no odorous blossoms,
No flowers of sprightly hue,
Of azure, gold or purple,
To shrine the diamond dew.
But with a magic shaping
No colours could enhance,
Ye grow in constant beauty,
And matchless elegance.

Grace guideth every fibre
That creepeth through the green,
The work of Beauty's fingers
In every curve is seen.

And a reference to *Osmunda regalis* in another Victorian poem from Deakin's *Floragraphia Britannica* Vol 4 1848, a Francis and Newman contemporary that I didn't know of until recently.

Auld Botany Ben was wont to jog
Thro' rotten slough and quagmire bog,
Or brimful dykes and marshes dank,
Where Jack-o-lanterns play and prank,
To seek a cryptogamic store,
Of carex, moss, and fungus hoare,
Of ferns and brakes, and such like sights
As tempt the scientific wights,
On Winter's day; but most his joy
Was finding what's called Osman Roy.

I wonder how many west London suburbanites were "wont to jog thro' rotten Slough"? Not all would approve of listing *Carex* as a cryptogam, though that might explain Clive Jermy's dual interests. Pedants might quibble about the distinction between "ferns" and "brakes" but that crops up often enough. Authorship is not indicated, so it could be Deakin himself.

Adrian Dyer

BPS Special Publications

May be purchased from BPS Booksales

see opposite page 96

BPS Special Publication No. 1.
A Guide to Hardy Ferns by **Richard Rush**
(1984, reprint 1987), 70 pages. ISBN 0 9509806 0 9

[No longer in print but sometimes available second hand at BPS meetings and elsewhere.] The book lists, in alphabetical order, 581 species of British and foreign ferns that can, or potentially could, be cultivated in British gardens. Typically it gives a one-paragraph description of each species, its country/continent of origin, its habitats, and the recorded experiences of hardiness by fern growers in the UK. No illustrations.

BPS Special Publication No. 2
Fern Names and Their Meanings by **J. W. Dyce**
(1988), 31 pages, £4.50 plus p&p. ISBN 0 9509806 1 7

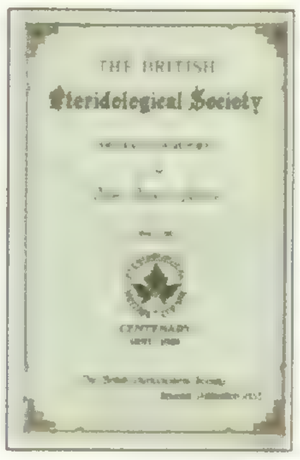
Provides explanations for the naming of the genera of British ferns, in alphabetical order from *Adiantum* to *Woodsia*; also the meanings of Latin and Greek prefixes in fern names (e.g. *Crypto-*, *Oreo-*, *Tricho-*). Contains a dictionary of the taxonomic words used to describe fern fronds and other anatomical features. Illustrated with line drawings.

BPS Special Publication No. 3
The Cultivation and Propagation of British Ferns **by J. W. Dyce**
(2000), 41 pages, £5.00 plus p&p. ISBN 0 950806 2 5

After a brief introduction to fern anatomy and life history, the main part of this publication deals with fern habitats in the wild and the cultural requirements needed in a garden. It describes how to grow ferns from spores, vegetative propagation, and the few diseases to which ferns are liable. It goes on to recommend the species and cultivars suitable for different habitats within a British garden, and the best of the foreign hardy ferns. Illustrated with black and white photographs.

BPS Special Publication No. 4
The History of British Pteridology **edited by J. M. Camus**
(1991), 127 pages, £6.00 plus p&p. ISBN 0 9509806 3 3

This multi-author work by leading pteridologists was produced to mark the Centenary of the BPS in 1991. Wide-ranging and very readable, it provides a satisfying overview of the personalities and developments that shaped the BPS. From fossil ferns through antique books, to conservation and horticulture, it gives essential background information on pteridology, including a summary history of the BPS, through the eyes of fern enthusiasts. Illustrated with black and white photographs.



BPS Special Publication No. 5
The British Pteridological Society, Abstracts and Reports, 1894-1905
(1991), 245 pages, £7.50 plus p&p. ISBN 0 9509806 4 1

A facsimile compilation of the reports and papers produced by the BPS during its early years and before regular journals or magazines had been established. It describes the meetings and interests of fern growers from over 100 years ago and their experiences on field excursions, and especially with the finding and growing of cultivars of British ferns in the late Victorian era. Illustrated with black and white photographs and engravings.

BPS Special Publication No. 6
The BPS Minute Book CD (1891-1983) **ed. by Barry Wright**
(2002), 633 facsimile pages on CD-ROM, £10 plus p&p. ISBN 0-9509806-5-X

This unique pteridological archive documents the birth and changing fortunes of the BPS – the world's oldest Fern Society - as recorded in 93 years of the BPS Committee Minute Book from 1891 to 1983. The original Minute Book itself – the Society's most valuable document - exists only as a single 3-kg bound volume with marbled covers and ruled lines. Entries are in handwriting in the early years and as stuck-in typescript later. The CD facsimile presents all the 633 pages of recorded Committee deliberations up to 1983.

SHIELD FERNS IN CORNWALL AND THE ISLES OF SCILLY

Rosaline J. Murphy

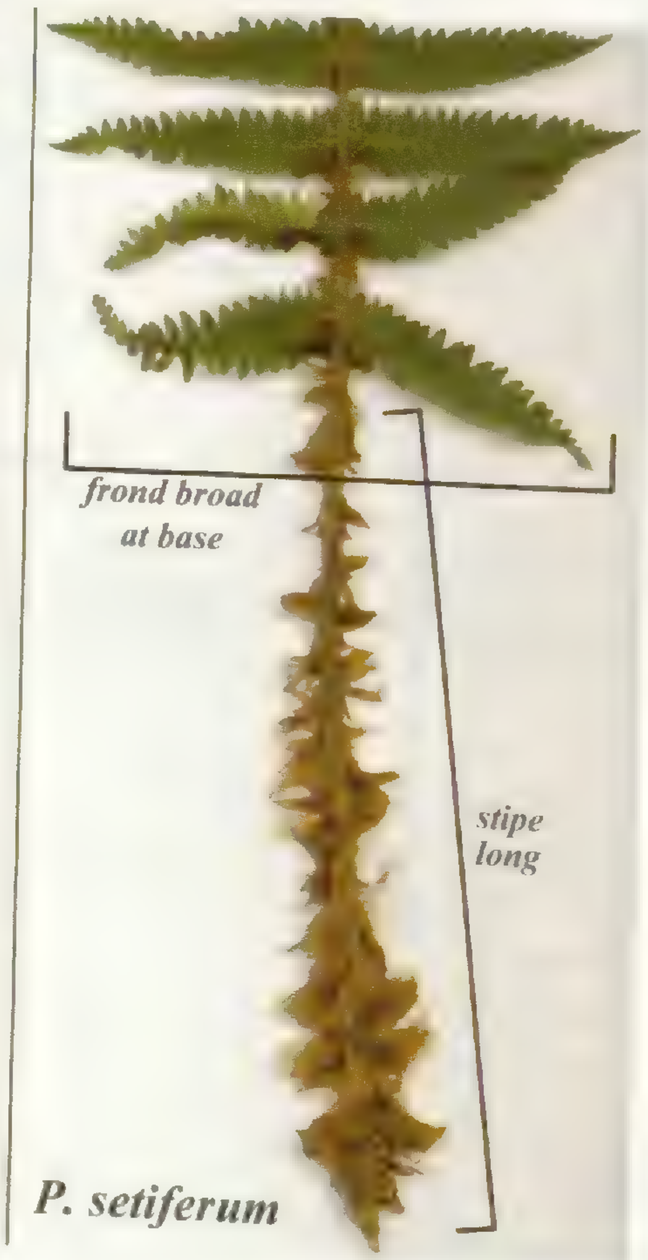
Of the two shield ferns that occur in Cornwall *Polystichum aculeatum* is the rarer, so rare that unless the old records are supported by a herbarium specimen they are difficult to believe. This Eurasian-Temperate fern (Preston & Hill, 1997) grows best in Britain in cool, moist, base-rich conditions and distribution maps of its occurrence in this country show it to be more frequent in the north and west (Jermy *et al.*, 1978; Preston, Pearman & Dines, 2002). However it is almost absent from neutral to acid Cornwall, indeed the line of division has been so marked that it is as though it reaches the River Tamar (the county boundary) and refuses to cross the water!

In contrast to this the Submediterranean-Subatlantic *P. setiferum* (Preston & Hill, 1997) is everywhere in the county, growing in woods, on shady Cornish hedgebanks, on stream and river banks, in disused quarries and churchyards and even sometimes along those low Cornish hedges that make incursions onto Bodmin Moor.

As is well known, soft shield fern is extremely variable and some of us will never forget the sight of *P. setiferum* 'Carrugatt' along an overgrown, very damp and muddy lane near Par in 1988. However, it is this very variability that can add so much to the difficulties of identification.

Cornwall's climate does not help either. The salt-laden gales, the sudden torrential storms of rain and the sharp though infrequent frosts all leave their mark on the ferns that grow here. Where soft shield fern is exposed to such extremes the fronds can seem as tough as those of hard shield fern and with these plants it is all too easy to mistake them for *P. aculeatum*.

P. aculeatum



P. setiferum

'Typical' *Polystichum aculeatum*
Frond base *top left*; pinnules *above*

THE BRITISH SHIELD FERNS

Rosaline J. Murphy
Reskadinnick, Camborne,
Cornwall TR14 0BH

&

James Merryweather

Through our correspondence, Rose and I discovered that we were concurrently bothered by two of our shield ferns, she recording the ferns of Cornwall and I teaching in the north. Our problems overlap but are not the same, so we decided that they and our solutions would be best presented side by side rather than combined.

Invariably now, I find myself examining the spores of doubtful specimens to confirm their identification. Spores of *P. aculeatum* are dark-brown but those of *P. setiferum* are smaller and lighter in colour with a distinct winged perispore. Only three of the older Cornish records for *P. aculeatum* are now accepted, these having herbarium specimens to support them. They are from:

1. Wendron, near Helston, 1875
J. Cunnack (K)
2. St Dominick, 1868
T.A. Briggs (BM)
3. Carkeel, near Saltash, 1875
T.A. Briggs (BM)

This means that there had been no confirmed records for *P. aculeatum* in Cornwall and the Isles of Scilly since 1868/1875. Anne Sleep had written against the 1954 specimen of shield fern from Place Manor near St. Anthony (BM), "I think this is *P. setiferum*". She added further information in support of her statement. Then the herbarium material (pre-1900) in the Museum on St. Mary's, Isles of Scilly has also been re-assessed and is now considered by various recorders, including BSBI recorder for the islands, Rosemary Parslow, to be *P. setiferum* and not *P. aculeatum* as first suggested.

The break-through came in 1994 when Mary

'Typical' *Polystichum setiferum*
Frond base *top right*; pinnules *above*

Atkinson, a BPS member, found *P. aculeatum* at Phoenix United Mine near Minions (SX 267720). Identification was supported by the texture of the fronds (harsh to the touch), the length of the lowest pinnae (half the length of the longest middle ones) and the pinnules which were sessile with an acute angle in their bases. Spores were abundant, dark-brown and large (40 µm) with not a trace of a winged perispore. The only problem was in the length of the stipe. Some of the textbooks give varying statements in relation to this. In

***P. aculeatum* - Cornwall**

P. setiferum the stipe is described as being "usually more than $^1/_6$ of leaf length", or "$^1/_4$ to $^1/_2$ as long as rachis" In *P. aculeatum* it is described as being "usually less than $^1/_6$ of leaf length" or '$^1/_4$ to $^1/_5$ or less the length of the frond'. Perhaps the length of the stipe, although generally shorter in *P. aculeatum*, is not an absolutely, clear-cut

***P. setiferum* - Cornwall**

character. Certainly in the recent Plant Crib (Rich & Jermy, 1998) no mention is made of stipe length when considering the differences between *P. setiferum* and *P. aculeatum*. In the Phoenix-United Mine material the stipe is quite long and is between 1/3 to 1/4 the length of the rachis. This would make it *P. setiferum* but all the other characters point to *P. aculeatum*. Could the explanation lie in the habitat of the mine material? The ferns are growing in rectangular pits at the base of an old lime-mortared wall and one can imagine the stipes becoming longer than normal in order to get the fronds into the light.

The shape of the pinnules might seem a macro-character that is more useful than the others. In *P. setiferum* the pinnules are stalked with obtuse angles at their base and a distinct 'thumb', the lower edge of the pinnule being either parallel to the costa or even overlapping it. The 'thumb' often has a tendency to hide itself behind the next pinnule so that it often can be seen more clearly from the back of the frond. In *P. aculeatum* the pinnules are sessile, with acute angles at their base and a tendency for the pinnules to run into one another at the end of the pinnae. However, the character I like best shows when one holds the fronds up to the light. Then one can see that more light shines through between pinnules and costa in *P. aculeatum* than in *P. setiferum*.

The 1994 find proved to be the stimulus for still further finds of hard shield fern all interestingly and half-expected, being limited to the far east of the county, often in association with the Rivers Tamar and Inny. The most fascinating and historically interesting was, however, the refind, of *P. aculeatum* in 2002 at St Dominick. In his 1868 *Flora of Plymouth* T.R. Archer Briggs wrote that *P. aculeatum* was growing on "a dry, exposed hedgebank near St Dominick" and also "many years ago in a small wood there". R.J.M. provided the information, L.J. Bennallick identified the wood and Mary Atkinson found the plant. A wonderful end to a field day, refinding a fern that had not been seen for over 130 years!

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WHAT'S THE DIFFERENCE?

James Merryweather

We only have two species of shield fern in Britain and all of us who know them well have no difficulty telling them apart. Our other *Polystichum*, holly fern (*P. lonchitis*), is easily identified by a combination of altitude, habitat and its characteristic undivided, holly fern shaped pinnae. If you are still in doubt, you can check for sori, the presence of which should differentiate small *P. lonchitis* from the juvenile or 'bonsai' *P. aculeatum* that abound to the confusion of the unaware, *but* usually in places where *P. lonchitis* would never grow.

Juvenile *Polystichum aculeatum*

Polystichum lonchitis

It's not the holly fern that raises problems; it's the other two (hard shield fern *P. aculeatum* and soft shield fern *P. setiferum*), and it's not me who has the problem, not with identification itself, but those to whom I try to explain how to tell them apart. I don't so much find that the diagnostics we have available don't work, but they have serious limitations when: a) I have to provide concise, indeed brief, mutually exclusive, effective identification tools when creating field guides (Merryweather & Hill, 1991; Merryweather & Roberts, *in press*) and b) in field course teaching I have only one of the pair for the participants to look at.

If you tell someone inspecting a mature frond of *P. aculeatum* that, in contrast, the pinnules of *P. setiferum* are distinctly stalked, they will reply that the pinnules of their specimen are

certainly stalked, so how can that be a difference? When is a stalk not a stalk?

If you tell them that the angle in the pinnule base of *P. aculeatum* is acute (the difference between acute and obtuse often requires explanation) but that of *P. setiferum* is obtuse they will show you in return plenty of *P. aculeatum* pinnules which are at best equivocal in this respect. If you have the luxury of a frond of *P. setiferum* to hand, then it's easy to show the unbeliever what you mean and give them a grasp of the need to calculate a mental average for these features, but where I teach, in the Lake District and North-western Scotland, only the one species (*P. aculeatum*) is generally available, so that's not possible. [Yes, I know it grows in Cumbria, but not along one of my customary teaching itineraries.]

In my experience, *P. setiferum* is the less variable, but my teaching has tended to take place where it is uncommon or absent and Rose Murphy's experience is to the contrary!

Angle acute or obtuse?
most acute, some only just, some obtuse

Stalked, adnate or sessile?
very dependent upon interpretation

Pinnules of *P. aculeatum*

Angle always ± obtuse

Always distinctly stalked?
nearly, but not quite always

Pinnules of *P. setiferum*

The same problems occur with other properties that differentiate these two ferns, but none is as clear-cut as the breadth of the lowest pinnae in relation to those at mid-frond and, perhaps, the length (or shortness) of the stipe. But those features alone are not sufficient to satisfy a curious student or effect a confident identification in a key, and others are essential.

I have exchanged thoughts with Rose who pursues similar activities to me at the opposite end of Britain. Her problem is the converse of mine, for in Cornwall there are plenty of *P. setiferum* whilst *P. aculeatum* is rare. The problems of the southwest region are compounded if someone with a critical eye searches for shield ferns frequently. Some specimens of *P. setiferum* can exhibit features that can cause even experts like Rose and her team to question their identity or even to mistake some plants, albeit briefly, for *P. aculeatum* or something previously unrecognised. I find myself baffled that one of the most famous *Polystichum* varieties is called *P. setiferum* 'Pulcherrimum Bevis' and not *P. aculeatum* 'Pulcherrimum Bevis', for it looks very much like the latter species. On what grounds is it called *P. setiferum*? I expect somebody has counted its chromosomes and found 82, rather than the 164 of *P. aculeatum*. That doesn't change its apparently wrong appearance.

What's the answer? We must attempt to redefine the identification procedure so that keys actually work and when using keys a suite of as many characters as possible must be considered, rather than relying on a single one which might be quite variable. The remedy for field teaching problems is actually very simple. The tutor can carry some examples of both or at least the absent species. They can be pressed fronds, laminated to protect them from the weather, rucksack crumpling and the probing fingers of generations of students, and everyone can receive a photocopied handout showing 'typical' fronds, pinnae and pinnules.

If only the word 'typical' were relevant or useful. When you teach - or rather, when you want people to *learn* - you soon discover that there's no such thing as 'typical', and if you're rash enough to use the word, there's always someone who will very reasonably expose the exceptions and dash your precious diagnostic absolute *in pieces like a potter's vessel*. 'Typical' is of no more use than pivotal characters that are only seasonally present (usually absent when you need them), subjective characters that render many keys useless if comparators are lacking (as, frequently, they are) and that overworked and entirely unhelpful word 'somewhat', which is so often inserted to cover indefinable variability or disguise the uncertainty of compilers of the identification tools we all rely upon.

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A NEW BLECHNUM Varieties of *Blechnum spicant* have rarely been found in the wild, and there are few good ones available today. However, the editor recently found this in Scotland and it is certainly interesting if not a ravishing beauty. With permission of the Forestry Commission it has been lifted and brought into cultivation. We shall see if it can be propagated and made available to fern growers.

IDENTIFICATION

Polypodium cambricum IN THE NEW FOREST

Robin Walls,[1] Alison Bolton & Martin Rand

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During the winter of 2003/4 the three of us investigated the polypodies in New Forest woodlands where one of us (AB) had found colonies that she believed to be *Polypodium cambricum*. Other than the first record by George Peterken in 1966 (Brewis, Bowman & Rose) and a record from Dave Winsland in 1989, all sites for this taxon in Hampshire have been from old walls, and the nearest Dorset site is a limestone cliff on Portland. The contrast between a dry, calcareous substratum in an exposed situation and a moss covered oak branch deep in an ancient woodland could scarcely be greater.

By far the commonest polypody in the New Forest is *P. interjectum*, and it can be abundant as an epiphyte. In three woodlands we also found many trees with fronds that looked like *P. cambricum*, but mainly on branches over 2 m above the ground. We collected a range of fronds for closer examination, after a bit of climbing or using a long handled pruning device. Many of these fronds did indeed have branched paraphyses in the sori and Alison Paul (Natural History Museum) kindly confirmed the identity of the first frond we collected.

Identifying plants through binoculars was not entirely reliable and when we had a number of fronds, mostly collected as putative *P. cambricum*, it was possible to investigate how good the commonly cited gross morphological features are for distinguishing between species. We measured the blade length and maximum width as well as the number of pinnae pairs and the position of the longest pinna from the base. This gave us two indices for the frond shape: length to width ratio and fractional position of the widest point. We added two characters from the sporangium (the number of indurated cells and the number of basal cells) and performed a principle components analysis. This separated the two species fairly well

Epiphytic *Polypodium cambricum* near Lawrenny, Pembrokeshire

but it was not possible to draw a simple line dividing those with paraphyses from those without. Were these the hybrid *P.* x *shivasiae* or just misidentified?

We sent a number of fronds to the referee, Rob Cooke, who confirmed our identifications and indeed we had found the hybrid, a new county record. With a re-examination of the data in the light of Rob's letter it was apparent that the cell counts from the sporangia and the presence of paraphyses were good characters, but the shape of the frond was not. As a rough estimate, you are only likely to be right 70% of the time. Other characters we considered were the degree of toothing on the pinnae, the angle of the pinnae to the rachis, colour and the presence of an elongate tip to the frond. None of these seemed to be much better than looking for broad, triangular fronds.

Preliminary conclusions are firstly, that to identify *P. cambricum* there is no alternative to looking at the sori under a microscope. Prelli (2001) notes "Identification of *Polypodium* by macroscopic characters alone is often uncertain. Microscopic characters, on the other hand, give reliable results. They can be easily observed, even at low power, from detached, slide-mounted sori". Secondly, despite the overwhelming impression given by the usual floras (eg. Jermy & Camus 1991 or Page 1997) that *P. cambricum* is only found on base-rich rocks (or when on trees, in strictly coastal locations), it is perfectly happy growing as an epiphyte on oak inland. In the latter habitat it is very likely to be growing near *P. interjectum* with the obvious consequences. The next questions are what are the limits of this niche and how widespread. We would be interested to hear of other records of epiphytic *P. cambricum*, with information on the type of woodland and the identity of the tree on which it is growing.

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Tree-Fern Newsletter No. 10

Edited by Alastair C. Wardlaw

Convener of BPS Tree-Fern Special Interest Group

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The Tree-Fern Special Interest Group is now ten years old, the decision to establish it having been taken at a meeting of the BPS Committee in 1994, with the birth announcement appearing in the 1995 *Bulletin* [**6**(4) p. 275].

Martin Rickard circulated the first Newsletter about a year later, since when it has appeared at approximately annual intervals. **Copies of earlier issues** have been requested by several members. I hope therefore to assemble the first ten issues with an index, and make it generally available.

Interest in tree ferns is certainly not flagging. We had a very successful and well-attended all-day ***Mini-Symposium on Tree Ferns*** at Kew on 8th November 2003. As it was part of the regular BPS Indoor Meetings Programme, a report has appeared in the 2003 *Bulletin* and will not be duplicated here.

The ***Survey of Tree Ferns in Cultivation***, started in September 2003, is still receiving inputs by members of the TFSIG. So far, 41 species of tree fern are included. The final report will be distributed to all those who sent in a return, or expressed interest.

The attractive **360-page book on *Tree Ferns* by M.F. Large & J.E. Braggins** (ISBN 0881926302) from Timber Press is now available. Recently it was offered on the web by Amazon, at £21.19, p&p extra.

Pictures, notes and longer articles on tree ferns should be sent to me for **the next TF Newsletter**. I am generally short of copy!

Disclaimer: Views expressed in this Newsletter are not necessarily those of the British Pteridological Society. ACW

Above: The Norfolk Island Tree Fern, *Cyathea brownii* (left), in Melbourne Botanic Gardens. It illustrates why binoculars and a shotgun may sometimes be needed to collect tree fern spores!

Opposite: detail of stipe scars on trunk

Tree-fern Conservation?

Peter Lynch

7 Fairview Avenue, Earley, Reading Berkshire RG6 1HE, UK.

Visiting New Zealand in March 2003, I was horrified to see the scale of destruction of native tree-fern forests. On the North Island it was common to see six- to eight-foot tree-fern trunks being used as an alternative to general building material. I first noticed it, on a massive scale, in the town of Taupo, located on the northshore of Lake Taupo.

Palisade of tree-fern trunks, some still alive, at Rotorua Youth Hostel.

Walking along the town lake front, I strolled down some steps to the small beach to see how warm the water was and, as I turned around, was astounded to see a wall of tree-fern trunks stretching away in both directions. They seemed countless in number - thousands upon thousands! At first I thought what a magnificent sight! But then it dawned on me that this was the result of the wholesale destruction of native forests.

Tree-fern trunks being used as bunker edging on Wairakei International Golf Course. (Reproduced with permission of *Destination Lake Taupo*)

Driving north towards Rotorua from Taupo, I passed through thousands of acres of monoculture coniferous forest and guessed that this is what had replaced the original native forest with tree ferns. Major tree felling began around Taupo in 1898. The first commercial crop forests were planted in 1925 and harvested in 1950. Opposite is a picture of the boundary fence of the YHA hostel in Rotorua. Such fences were not an unusual sight; the other picture is of the Golf Course at Taupo.

I have contacted several local and national organisations in New Zealand but they all claimed that the Taupo tree-fern constructions were nothing to do with them. I am therefore still in the dark about which agency was responsible. The New Zealand Government, I was pleased to find, has recently produced a *Biodiversity Strategy* but surprisingly it contains no reference to the country's unique, indigenous tree-fern heritage. Via the Government web-site I asked why this was so and was told "tree ferns are not endangered species and therefore do not warrant particular attention". I was further informed, "they are a common under-story species and are used as retaining material because otherwise they would be burnt when the forests are harvested". It was also said that, "the tree ferns reintroduce themselves when new pine plantings are made".

This sounds like a reasonable explanation, except that tree ferns are much slower growing than conifers, so I find it hard to believe that they could grow eight-foot trunks within the time-frame of a coniferous forest harvesting cycle (25-30 years). Also, in my experience, coniferous forests are notoriously barren with regards to any understory. Elsewhere I did see tree ferns growing under trees at Pelorus Bridge on the South Island, but the overhead canopy was broad-leaf woodland.

I would be very pleased to hear from anyone who can shed further light on what is really happening in New Zealand. But at least it seems that tree fern enthusiasts in the Northern Hemisphere can feel somewhat relieved that the importation of trunks of mature tree ferns from that country is not in itself endangering the common indigenous species.

News Flash: Man who named first *Dicksonia* was sabred to death by unknown assassin!

Maybe 'news flash' is a slight exaggeration, since the event took place in 1800. Nevertheless it *is* true that Charles-Louis L'Héritier de Brutelle, a French aristocrat, did meet this untimely end. Notably, 12 years earlier he had given the name *Dicksonia arborescens* to the tree fern which Sir Joseph Banks and Daniel Solander had collected on the Island of St Helena. It was growing at Kew where L'Héritier saw it when he came to London in 1786 and concocted its Latin name which is still valid today.

Although very rare in horticulture, *D. arborescens* is the type species of the genus *Dicksonia*, not *D. antarctica* which is so much more familiar.

L'Héritier was born in 1746 and became Superintendent of Waters and Forests of the Paris Region in 1772 and a judge in that city in 1775. As a keen amateur botanist, he travelled to London in 1786, intending to stay for 3 months but eventually extending it to 15. His main work as a visitor was to write a book entitled *Sertum Anglicum* which translates from Latin as *An English Bouquet* (or *Wreath*).

CAR. LUD. L'HÉRITIER, Dom. DE BRUTELLE,
in Aula Juvem. Par. Reg. Consil.

SERTUM ANGLICUM,

SEU

PLANTÆ RARIORES

QUÆ IN HORTIS JUXTA LONDINUM,

IMPRIMIS

IN HORTO REGIO KEWENSI

EXCOLUNTUR

Ab anno 1786 ad annum 1787 observatæ.

PARISIIS,

TYPIS PETRI-FRANCISCI DIDOT.

Prostat { PARISIIS, apud { LUD. NIC. PRÉVOST. / THEOPHIL. BARROIS.
LONDINI, apud PETR. ELMSLY.
VIENNÆ et LIPSIÆ, apud RUD. GRÆFFER.
ARGENTORATI, apud AMAND. KOENIG.

1788.

Title page of *Sertum Anglicum* which translates as: An English Bouquet, or Rare Plants, which are cultivated in the gardens around London, especially in the Royal Gardens at Kew. Observed from the year 1786 to the year 1787.

The French aristocrat was evidently very well received during his stay in London and expressed his thanks charmingly, by naming plant species after British botanists. Thus the tree fern from St Helena was given the generic name *Dicksonia*, in honour of James Dickson (1738-1822), a nurseryman and botanist who wrote about British cryptogams and flowering plants. The species name *arborescens* means *becoming tree-like*.

Dicksonia arborescens L'Hérit., to give it its name, with the authority in standard abbreviation, is endemic to St Helena, where it grows at an altitude of around 900 m on the mountain ridge in the centre of the island. It is not an IUCN Red List species, but must inevitably be vulnerable, through having such a restricted habitat and not being available in horticulture.

The ancestors of *D. arborescens*, and how they got to St Helena, are complete mysteries. At latitude 16 °S, St Helena is only 10 x 17 km and has 122 square km of land surface, mainly mountainous and eroded. It emerged volcanically from the Atlantic Ocean 14 million years ago. Famous as the last residence of Napoleon Bonaparte, the island is 2000 km off the coast of South-West Africa, a Continent where there are no *Dicksonia* species (today). In a westerly direction, but 2900 km distant, is South America where *D. sellowiana* and *D. stuebellii* are found.

D. arborescens is not in trade and has not appeared in recent lists of the BPS Spore Exchange. It may however be seen under glass at the Royal Botanic Garden Edinburgh.

Just to round off the story of L'Héritier, he was sabred to death on the night of 16th August 1800, near his house on the outskirts of Paris, by an unknown assassin with unknown motives.

Fewer than 100 copies of *Sertum Anglicum* were ever produced and of these only about 50 are known today. In 1963 a facsimile edition, with translation and scholarly commentary, was published by The Rachel McMasters Miller Hunt Botanical Library, Carnegie Institute of Technology, Pittsburgh, Pennsylvania.

See: www.abebooks.com for second-hand copies.

Dicksonia arborescens
in J.D. Hooker's *Species Filicum* (1844).

Dicksonia antarctica in Central London

I know of several private gardens in London with one, or a few, *Dicksonia antarctica*, but to see over 20 of them in a city park was quite a surprise! The place is Postman's Park, off Aldersgate, between St Paul's and the Museum of London. It is surrounded by tall buildings, extensively treed, and with what looked like hard, dry soil. Not a promising place to grow tree ferns!

Clumps of *D. antarctica* in Postman's Park. *Above*: well-grown specimens, *below*: perhaps struggling a bit.

On the day of my visit in late March 2003, most of the 21 tree ferns that I counted had last year's fronds still green and in good condition – better than my *D. antarctica* in Glasgow. But then London is bound to be a lot milder! Some new croziers were uncurling.

A notice stated:

> ***Dicksonia antarctica* presented to the Corporation of London and planted by Peter Franklin, Master of the Worshipful Company of Gardeners on 4th June 1998.**

Therefore at the date of my visit the tree ferns had been through five winters and were evidently well established.

I spoke to a gardener who was doing a post-winter tidying up. He said that there was no automatic watering system for the park and that he used a hose as needed. The tree ferns, in addition, had a can of water poured into the crown once-weekly from March onwards until the autumn. There was no wrapping of trunks or stuffing of crowns with insulation over the winter

Among the smaller ferns growing among the tree ferns, were *Dryopteris erythrosora*, *Polypodium vulgare*, *Polystichum munitum* and *Polystichum setiferum*.

Exotic angiosperms included *Trachycarpus fortunei* and *Musa basjoo*, which looked good with the tree ferns growing close by. Camellias were in flower.

Altogether Postman's Park is a very relaxing place to sit on a bench and watch the tree ferns grow or, as some folk were doing on 23 March 2003, having a picnic lunch and enjoying a spot of sunshine through the bare trees.

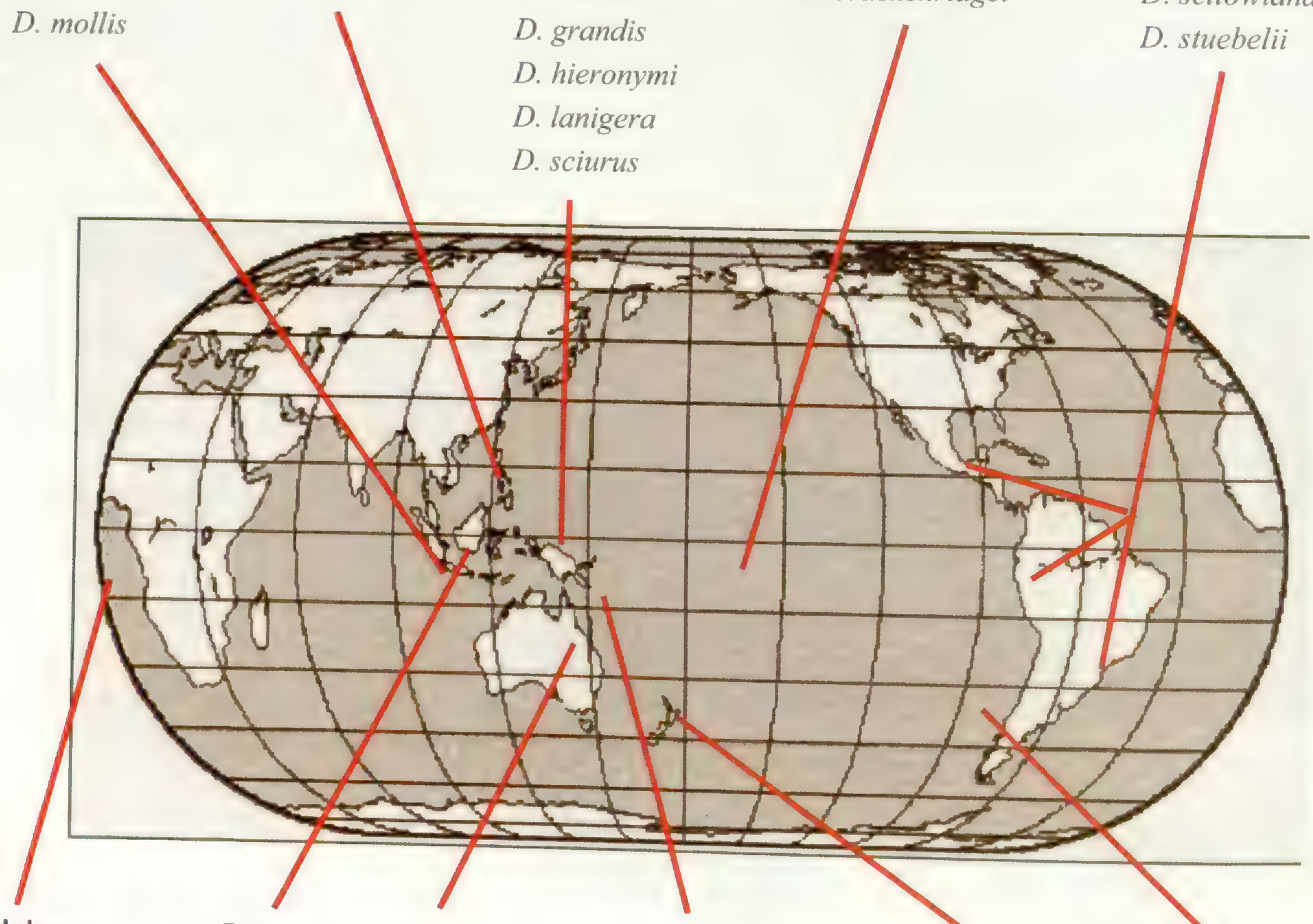
What looked like dead tree ferns, in very dry and cracked ground, under large trees.

World distribution of *Dicksonia* species

For some time now I have been trying to track down exactly how many species there are in the Genus *Dicksonia* worldwide, and where they occur. The accompanying map is based mainly on three sources from the web, as referenced at the end.

Hassler & Swale give the taxonomic authority for each species as well as the reference to the first publication of the species name. The other references provide particulars of world distribution and keys for identification.

For simplicity in what is just a brief bird's-eye view, I have left out the taxonomic authorities (like L'Héritier for *D. arborescens*).



Comments

- The distribution of *Dicksonia* species is tropical, subtropical and south temperate. There is no north temperate distribution.
- Total number of species seems to be about 21 or 22.
- The Type Species, *D. arborescens*, is endemic to the tiny and extremely isolated island of St Helena.
- No *Dicksonia* species occur in Continental Asia, Africa or Europe.
- No *Dicksonia* species grow in the islands of Japan or Hawaii, which have tree ferns of other genera.
- The centre of *Dicksonia* speciation seems to be New Guinea and neighbouring islands.
- Australia and New Zealand each have three species of *Dicksonia* but none is shared.
- The most widely distributed species, latitudinally, is *D. sellowiana*, which occurs from 30°N, in Southern Mexico, southwards to Uruguay, at 33°S.
- The two species on the Juan Fernandez Islands do not occur on mainland South America.
- I have not been able to place *D. domingensis* Desv. [*It was described from Hispaniola - AMP*]

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Michael Hassler & Brian Swale: http://homepages.caverock.net.nz/~bj/fern/dicksonia.htm
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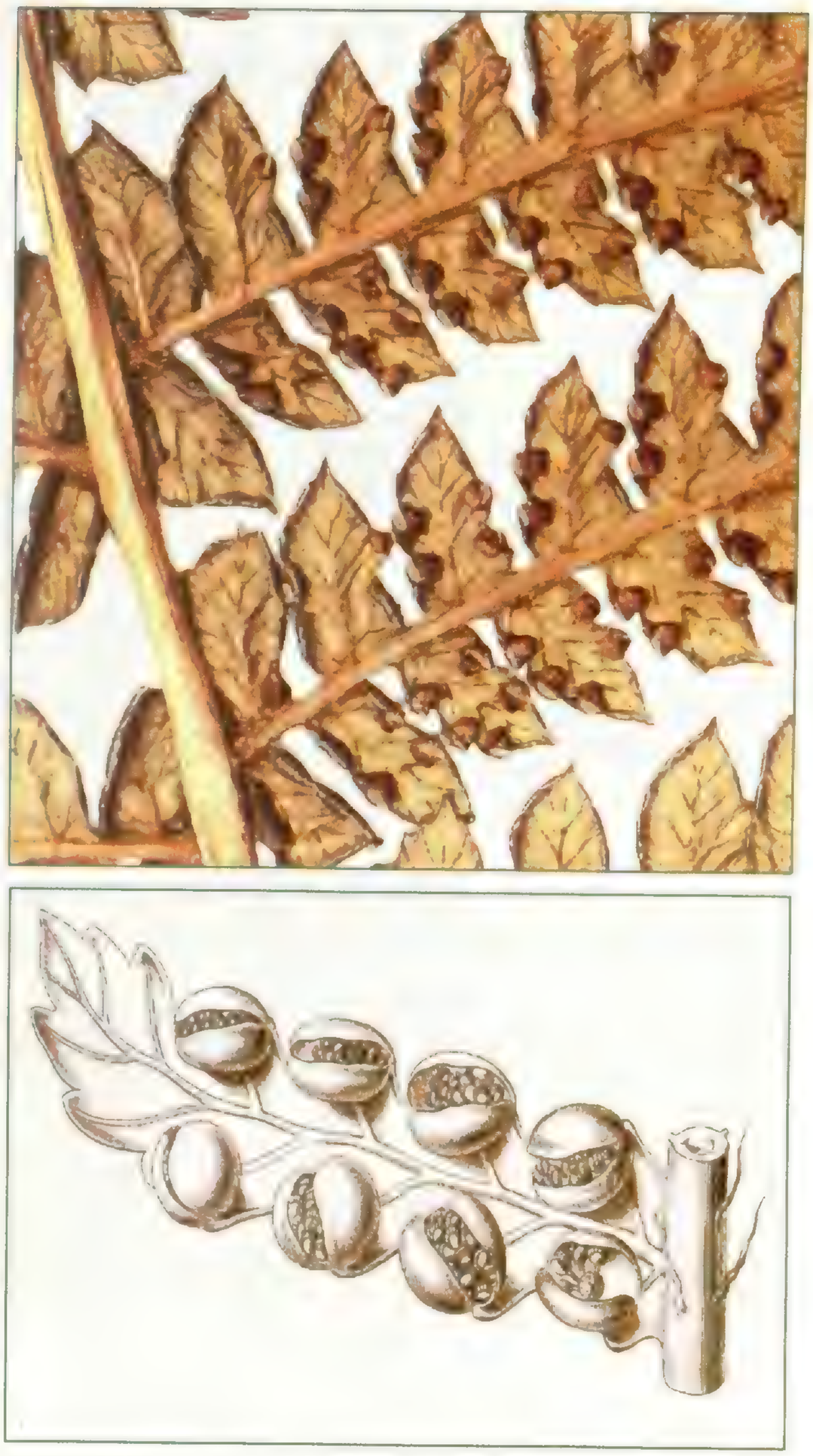
Tree ferns on herbarium sheets

Herbarium sheets and tree fern fronds were definitely not designed for each other. I long wondered how 2-metre fronds could be pressed and then mounted on the standard sheets. The answer is: *they aren't*! Like Dr Samuel Johnson with his imaginary dog walking on its hind legs, one did not expect to see it done well; indeed one was surprised to see it done at all!

Through the courtesy of Alison Paul, I spent a day in the Herbarium at The Natural History Museum in London, focusing on the collection of *Dicksonia*. There was over a one-metre thickness of folders with herbarium sheets, segregated by geographical regions.

Dicksonia brackenridgei Mett. stipe base and portion of frond collected on Western Samoa by W.A. Sledge, on 17 Feb, 1917, in the NHM (BM) Herbarium.

It was an interesting and rewarding experience. I am so accustomed to looking at living fronds attached to a living tree fern, that it took some adjustment to associate the brown fragments with anything lifelike - like trying in the mind's eye to resurrect the live person from an Egyptian mummy which had been under a roadroller.



Dicksonia sellowiana (C.Presl) Hook.: Portion of pressed fertile frond (Brazil, 1914) and accompanying line drawing, in the NHM (BM) Herbarium.

Photography in the Herbarium being allowed, I took a lot of pictures. The sample in the adjacent column shows that much of value is indeed preserved. It may not look very pretty, but at least some essential features are there: upper and lower surfaces of a fertile frond, and a stipe base with the diagnostic hairs of *Dicksonia*. The overall frond shape and tree fern trunk were notably absent.

On some specimens a lot of the details of sori and venation were well preserved, interpretation being helped by an accompanying line drawing, as shown above for *Dicksonia sellowiana*.

Reading the labels, one's imagination was taken to the faraway places where intrepid plant hunters had struggled through jungles and worked with plant presses under makeshift shelters in steamy tropical conditions. One could almost see the mosquitoes being swatted and the leeches being peeled off. My reverie was ended by Alison asking if I wanted a cup of tea.

FOCUS ON FERNERIES

SWISS GARDEN GROTTO & FERNERY

Nick Aikman

The Swiss Garden, Old Warden Park, Biggleswade, Bedfordshire SG18 9ER

Introduction

The Swiss Garden is managed by Bedfordshire County Council who have been restoring it since the late 1970s. The grotto was in total ruins but was restored to its former glory in the 1980s. As bad luck would have it, shortly after work had finished a very large *Picea abies* crashed down on the roof, so work had to start all over again.

The concept of a fernery seems not to have been grasped in those early days and it was suitably arranged with pelargoniums, variegated ivy and assorted bedding plants. By the time I started working in the garden in 1998 it was at least ferny, but dominated by large clumps of *Pteris* and quite run down.

In 2002 contractors were appointed to paint and reglaze the building, which gave me the opportunity to strip it out and replant.

The Fernery

The Grotto and its adjoining fernery is one of the main structures in the Swiss Garden. It was one of the original features of the garden, built in the 1830s under instruction of Robert Henley Ongley 3rd. It was later remodelled externally and internally by the Shuttleworths in the 1870s. At this time the porches and doors were added and Pulhamite was used to enhance the interior.

We have no record of what was planted in the Grotto in Lord Ongley's day. Therefore, I decided to keep to the theme of a Victorian fernery at the heyday of the Victorian fascination with collecting and displaying ferns.

The Grotto is a protected environment and it was heated during the winter for growing tender and exotic plants. The main house had its own walled garden for producing fruit and vegetables so presumably the Grotto was purely decorative in purpose.

With this in mind, plants have been selected mainly from New Zealand and Australia which are suited to a cool conservatory, but which would not survive outside in a British winter. It is impractical to keep the Grotto heated, so these plants are unusual and exotic to look at, but quite happy in their situation. As a safety precaution an electric fan heater, set on frost guard, is installed during the winter months.

I originally set out a planting plan in order to cost the plants required for replanting. Having determined the budget available I contacted Martin Rickard, widely regarded as the best supplier of ferns. With his superior knowledge of ferns suitable for the project I sought his advice. A visit to his nursery was timed immediately after containers from New Zealand and Australia had arrived to ensure the best choice of plants. As my knowledge of ferns is much more limited, with his help we substituted many of the run-of-the mill plants with some very choice ferns that are rare in cultivation. Thus, I am happy in the knowledge that we now have an excellent collection, of which any Victorian connoisseur would have been proud.

A key consideration was to ensure that there was a strong evergreen structure to the planting during the winter months. With this in mind tree

The fernery in its original state

The fernery in summer 2003

ferns and evergreen ferns were carefully set out first with deciduous plants filling in the areas in between.

The ferns are complemented by a collection of hostas that are a perfect foil and provide extra interest. Many of them are small leaved cultivars, which have been bred by a local hosta enthusiast. Not all plants grow well in this environment but those that have proved to thrive and fit in with the planting are included as well. These include *Smilacena racemosa*, *Uvularia grandiflora* and *Polygonatum* x *hybridum* (Solomon's seal).

It is difficult to ascertain introduction dates for ferns, but consultations with Shirley Hibberd's *The Fern Garden* (fourth edition, 1872) lists many ferns that were available at the time.

The planting is deliberately kept sparse to show off the plants. However, as some of the larger ones grow there will need to be some re-adjusting in order to keep the balance. The bigger plants should not be allowed to become dominant at the expense of the smaller ones.

The wisteria in the Grotto provides extra interest and will be extended through the season. Climbers such as the passion flower and the Chilean Glory vine could be planted. Also plants of special interest at certain times of the year could be placed in pots, for example choice varieties of hellebores and snowdrops, camellias, *Rhododendron fragrantissimum*, lilies and white arum lilies.

The fernery in 2002, before replanting

The fernery after replanting

Maintenance

- Beds are mulched with well rotted wood chip or leaf mould at least once a year.
- The wisteria is pruned. A single pruning before the leaves drop is the most labour effective.
- New wisteria growth is tied in during the summer and stems are not allowed to twist round the wire. In this way a woody framework can be formed away from the glass.
- Weeding takes place throughout the year.
- *Soleirolia soleirolii* (Mind your own business) is a constant problem. It is attractive in moderation, but if allowed to grow unchecked it smothers all the other plants. This is removed once or twice a year to allow the ferns and hostas to dominate. In particular, it is kept off the trunks of the tree ferns.
- Many of the pockets are very difficult to plant. A potting mixture of a loam based compost with added slow release nutrients and wetting agent works best. Watering is important as many of the pockets stay bone dry, but direct watering washes out the soil. Therefore they require spraying consistently to keep them moist. Self sporing of ferns is encouraged as much as possible as those that find themselves a place will do better than those that were planted. To this end, the stone and compost are kept moist.

The SWISS GARDEN

Old Warden Park, Old Warden, Biggleswade.
Bedfordshire SG18 9ER ☎ 01767 626236

🖳 www.bedfordshire.gov.uk/BedsCC/SDtopatt.nsf/We%5CThePage/The+Swiss+Garden

Gardeners' Chronicle 1896:142

Fern stealers. – William Mobey and Charles Williams, of Bexley, Kent, were charged at Totnes with damaging Devonshire hedges. The evidence went to show that prisoners were engaged with a horse and cart in the wholesale removal of Ferns, about 5 cwt. of roots being found in an outhouse. Previous convictions were recorded, and the Bench imposed fines – Mobey, £5; Williams, £2 10s.; together with the amount of damage. The money not being forthcoming, Mobey was sentenced to six weeks' hard labour, and Williams to one month.

The same issue carried advertisements for a new variety of pea on sale at 3 shillings per pint and the finest named hardy Rhododendron varieties from £7 10s upwards per 100. Might need some tricky maths to discover just how severe the sentences were.

Madge Stokes

ATTADALE GARDENS

James Merryweather

Peter Hainsworth's woodland garden at Achnashellach

The late Peter Hainsworth's Scottish highland home and garden are at Achnashellach in Wester Ross. For twenty-five years he was a regular visitor to the nearby Attadale estate, exploring the wild places as well as the Gardens at Attadale House. He was always a generous contributor of advice and plants, and in 1994 donated some ferns from his garden. This was just the beginning for what may become a major fern garden.

The entire Hainsworth fern collection is being translocated to Attadale Gardens. Now, in May 2004, most have arrived and many specimens have already flushed in their permanent places. Of course, some of those will have to be moved if they show signs of disliking where they have been put and many others are stored in a temporary bed, waiting for space to become available in suitable sites. A gigantic *Polystichum acrostichoides* has so far evaded capture because of its size and a team of strong-persons will be recruited to collect it, along with several limestone specialists. Since Attadale, like Ashnshellach, is situated on almost pure silica precambrian rocks the soils tend to be very acidic, so a special base-rich bed will be prepared for them.

Peter kept his tender ferns in a polytunnel and housing them was a priority for Nicky Macpherson, the owner of Attadale Gardens and Geoff Stephenson, head gardener. A geodesic dome was obtained and erected during the winter. Its frame sits on a yard-high, circular drystone wall. Geoff and Frances Mackenzie set about landscaping the interior, a process that required several changes in layout and the shifting and re-shifting of several tons of rock as the ideal design revealed itself and improvements were made. A small burn (stream) has been tamed so that it babbles through a rocky pool - the sound is enchanting - surrounded by beds which are now fully planted with ferns and other interesting plants (e.g. some intriguing *Biarum* species).

Before the Hainsworth collection could be removed it was my privilege to explore the whole garden and mark all the choice specimens as a guide for the Attadale gardeners. There were plenty of surprises and it was with some excitement that I came across the label ATHYRIUM FF CLARISSIMA by a fern with fronds only just beginning to unfurl. If the fern turns out to be what the label says it is - and we can trust Peter to have known his ferns - it will be quite a treasure for the gardens to exhibit. There is also a fine *Blechnum spicant* variety (still to collect) which I suspect is Martin Rickard's 'Serrate' for it resembles it and there are few good *Blechnum* varieties (see p. 78).

My special pleasure was to find several male ferns I haven't seen before, including *D. crassirhizoma* (considered by the late Hugh Corley possibly to have been involved in the ancestry of the British male ferns); numerous full-sized *D. wallichiana* (thought by others certainly also to have been) and another which is very pretty and I think will turn out to be *D. caucasica* (an ancestor of *D. filix-mas*). I can't be certain about the last yet because I've not seen living *D. caucasica* and this plant lacks a label, most unusual in the Hainsworth garden.

On a wall by the house there were numerous calcicolous plants and, as we prepared to leave at the end of our last 2003 visit to Achnashellach, I realised I'd failed to notice several unexpected holly ferns (*Polystichum lonchitis* - there is another huge one in the vegetable garden, not far from the biggest *Dryopteris oreades* you ever saw). There were also *Cystopteris fragilis* and *Gymnocarpium robertianum* growing in captivity, here in country that normally supports only acid lovers. On further investigation, I discovered that Peter had made good use of the old mortared station platform which looks for all the world like a genuine garden feature.

The Hainsworth collection is now all but safely gathered in and Attadale Gardens is poised to become a honeypot for fern lovers, so if you're touring the Highlands, remember to visit. Let some images speak for themselves. ➔

May 2004. Temporary planting of around eighty choice ferns: e.g. 1. *Polystichum proliferum*; 2. *Dryopteris wallichiana*; 3. *D.* x *dewevere*; 4. *P. makinoi*; 5. several *D. filix-mas* 'Barnesii'; 6. *D. crassirhizoma*; 7. a large & beautiful buckler fern labelled *Dryopteris munchii*; 8. a broad, plumose, lightly crested variety of *Athyrium filix-femina* from the Yorkshire Bolton collection, ex Jack Bouckley; 9. *Woodwardia unigemmata* (thought to have been a casualty of the move, but it's hanging with a single frond).

OPPOSITE:
1. Inside the dome. The burn and rockeries planted with ferns. **2.** Alastair Wardlaw in discussion with Geoff Stephenson. **3.** Martin Rickard identifies unknowns. **4.** The highland gardener's lament: "So much rain, so many midges . . . . too many ferns!" **5.** *Woodwardia. Cyrtomium* etc. before transfer. **6.** The dome.

ATTADALE GARDENS
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ATTADALE GARDENS

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THE BPS SPORE EXCHANGE

HOW DOES THE BPS SPORE EXCHANGE WORK?

Anne & Barry Wright
130 Prince Rupert Drive,
Tockwith, YO26 7PU

Equipment

We don't know what sort of concept you have of the Spore Exchange. If you imagine rows of gleaming fridges and neatly set out working areas maintaining dust-free and sterile conditions, think again. We have a somewhat ancient but fully functioning BPS fridge that keeps the spores at approximately 4 ºC. We have been advised that fridges run most economically when full, as this evens out the temperature when the door is opened and closed. So we have installed temperature buffers in the form of several bottles of 'Theakston's Old Peculiar' (strong Yorkshire ale to anyone unfortunate enough to live anywhere other than the centre of the universe!). The only down-side of this is the need for frequent replenishment to maintain efficiency as a thermal capacitor!

Our dining table used to be the work area, but we have now ousted the microscopes from their desk in the computer/microscope room.

It may surprise you to learn that the entire Spore Bank is kept in four moderately-sized air-tight sandwich boxes of average Christmas cake size. Beyond this, there is little technical equipment needed to run the Spore Exchange.

Receiving Donations

So how does the Exchange work? It begins with the donations, as we can't distribute any spores until we have received some from our keen band of donors. We then send them out and hope that the recipients will, in turn, donate some spores back into the exchange and so keep the process going.

In theory, the Exchange begins in the late summer and autumn with the slow trickle of donations from UK and overseas members. In practice, we never seem to have much of a break. As many of you will realise, donor 13 is very busy in summer amassing piles of spore collection packets in the unused fire-grate in our dining room. This is an excellent place to air off spores and dry them out.

Donations are very variable. Sometimes we get perfectly packeted and very clean spores in good quantity. On other occasions we receive donations taken at the wrong time which yield few or no spores. Even some botanic gardens have sent us tiny fragments of frond without a single sorus, let alone ripe spores. If you, the reader, are intending to become a donor, all we expect is that you send a modest amount of spore either cleaned to the best of your ability or in the original paper bag or envelope in which the fertile frond was collected. We are quite adept at quickly cleaning and processing spores to produce a sample for the Exchange. Cleaning involves the sheet of glass and Stanley knife blade technique as described in our article *The 'Wright' way to clean and collect spores* (*Pteridologist* 3:4, 62-4, 1999). One reason you might prefer to send in cleaned spores is that they will be less bulky and save postage. But, let's face it: we will take anything you are prepared to send, although we would prefer that you checked that some spores are present.

Database

Having received the spores we then need to log on the computer who the donor was and the species donated. This will enable the tracing of any spores sent out.

In the past we have tended to be too busy to do much more than log these donations and thank the donors. From 2003 onwards we have dealt with donations differently. It has taken us several years of running the exchange to fine-tune the system to be able to provide what we hope is an efficient and speedy service.

Previously we were reluctant to divide the donations into a fixed number of packets as this would be

Storage of spore packets with coloured paper clips to show accession status.

time consuming, require large numbers of *glassine* envelopes at 2p each and take up extra space in the spore fridge. The technique we have developed over the years now suits us very well. The donations are divided into small aluminium kitchen foil packets which are reasonably spore-tight, so that, we hope, they are easy to handle when sowing. A problem with any form of paper packet is that the spores tend to stick to the paper, unless it is greaseproof or tracing paper, in which case the material is too resilient, springy and difficult to handle. The advantage of metallic foil is that it stays where it is put and does not flick the spores around to produce unexpected and disastrous movements when being handled.

Numbering System

We still use the same tried and tested numbering system where the year of donation appears first, then a unique species identification number followed by the identification number of the donor. There are minor problems with the species number, in that we still have to resolve how we can indicate that certain species may be available as both garden origin and wild collected. In some cases the wild collected spores may have been sent with precise details of the location collection. This information may be of use to the person requesting the spores and we are hoping to be able to provide this information either on the spore list, or on the sheet of paper each member receives with their allocation of spores.

We also aim to publish on the BPS Website photos or scans of unknown species on the list, e.g. those listed as "*Polystichum* sp. 3000 m Nepal" or just "*Pteris* sp." If donors will send us copies of photos or scans we can get them posted. We have some lovely species collected by the Alpine Garden Society in Japan and China. They have still not been named, but might be more widely requested if people knew that they were hardy, and what they looked like.

It might also be useful if donors sending in collected spores could indicate the probable hardiness of the species. The label: "*Polystichum* sp. 3000 m Nepal" may not mean much to some members who will be unsure as to whether 3000 m in Nepal is arctic, temperate or tropical. The hardiness zone system by the US Dept. of Agriculture (USDA) is the best system currently available, even though it is somewhat cumbersome. [See also articles from from Fern Hardiness Symposium, *Pteridologist* 3:2 (1997)]

Dispensing spores. Note safety precautions.

Once the allocation has been gathered together, the next stage is to enter the data in the computer. We use a simple Microsoft *Access* database to log all of the species being sent to each person requesting spores. Entering these data onto the computer, combined with the data already entered for donations, means that we have forwards and backwards traceability of any particular donation. So far, we have had relatively few requests for information on the donations of spores, but we feel it could be important in the future.

Using the computer database also means that we can analyse patterns of requests, which has enabled us to produce information that we and Alastair Wardlaw reported in *Pteridologist* 4:1, 20-5, 2002.

In order for us to identify a species for which we do not get adequate supply to service the requests, we have been going back through the request forms and entering data for species requested, but were unable to be fulfilled. In this way we have generated a list of frequently requested but unavailable species for the particular attention of donors.

The system we now use for distributing the spores is that, as donations come in, we break the bulk packets into between six and ten small foil packets, already labelled with the year, species and donation number. This has meant that, from the beginning of the Exchange in 2004, the majority of species have already been packeted and can be quickly extracted and added to the requests of members. As we proceed through the Exchange, these re-packeted species will eventually run out and we will have to spend time making up a further batch of six or ten packets. In the past we have had to do this, breaking down of the bulk packets from the outset of the distribution. This has meant that we have spent up to one-and-a-half hours on a single request. This is why we have tried to explain that members requesting spores should allow between six and eight weeks before getting concerned that their request has gone astray.

Finally

We hope this has given some insight into the working of the Exchange and explains why there can be a delay in turning the requests around. Please bear with us, we do our best and try to offer a good service. One final plea:

more donors please!

FRAGILE FERNS

The Blaschka Models at Harvard University

Susan M. Rossi-Wilcox
Botanical Museum of Harvard University,
Cambridge, Massachusetts USA

and

Stuart Lindsay
University of Michigan Herbarium,
Ann Arbor, Michigan USA

Behind the scenes

Ferns in the form of live plants and as herbarium specimens are familiar to all pteridologists. But to see ferns sculpted in glass you have to go to the unique collection in the Botanical Museum of Harvard University, in Cambridge, Massachusetts U.S.A. Except you will have a problem! None of the 800 exquisite glass specimens of plants on permanent display is of a pteridophyte. To see the glass models of the 19 species of ferns and 6 of fern allies requires a private visit behind the scenes. The purpose of this article is to take you there.

Glass model of hart's tongue, *Asplenium scolopendrium* var. 'Americanum'

Leopold Blaschka

Origin of the glass models

Known formally as *The Ware Collection of Blaschka Glass Models of Plants*, and popularly (but inaccurately) as *The Glass Flowers*, the collection was commissioned in 1886 by George L. Goodale, a faculty member of Harvard University. His intention was to create a permanent botanical exhibition, that would fascinate the public and help students understand the plant kingdom. In seeking an eye-catching display medium, Goodale found his answer in the glass models of sea anemones, jellyfish, and other marine invertebrates exhibited in the adjacent Harvard Museum of Comparative Zoology.

Rudolf Blaschka

FERNS AS ART

These zoological glass models had been made by the glass artists Leopold Blaschka and his son Rudolf, who lived in Hosterwitz, now a suburb of Dresden in Germany. After a visit from Goodale in 1886, the artists agreed to make a sample of botanical models which were duly delivered to Harvard a year later. Although the few models of flowering plants they sent had been broken by the customs officers, it was obvious to everyone at the Museum who saw them, that glass was an excellent medium for botanical display.

The Blaschkas were superbly talented. Not only were they from a well-educated Bohemian glass-working family, but they were well-versed in natural history. By the summer of 1876, when Rudolf had officially joined his father in business, the Blaschkas were selling scientific models of invertebrates to museums and universities worldwide. Today there are nearly 2,000 extant zoological models in the United Kingdom alone, with nearly 90 models at the Natural History Museum in London.

When Goodale convinced the Blaschkas to make a few models of plants during his first visit to Hosterwitz, they all regarded the project as a short-term arrangement. But the Blaschkas' models were so successful that the wealthy Bostonians, Mrs. Charles (Elizabeth) Ware and her daughter Mary Lee Ware, generously offered to underwrite a larger project almost immediately. With the Wares' support, other models were commissioned, cherry wood exhibit cases made, and Goodale began successfully attracting funds to build the Botanical Museum to house the exhibition, classrooms, laboratories, collections, and faculty offices. In 1890 with the completion of the building and only four years into the model-making project, the Blaschkas signed a 10-year contract to work full-time for the Botanical Museum. In that same year, the Wares dedicated the collection as a memorial for Charles Elliot Ware (Elizabeth's husband and Mary's father), a Harvard graduate who had taught on the Medical School faculty and was a noted naturalist.

Sadly, on 4 July 1895 Leopold Blaschka died suddenly of a stroke at the age of 73. But astonishingly, in the nine years that he and his son had worked together on the botanical models, they managed to craft over 570 species of plants; that is nearly three-quarters of the models in the final collection. Goodale, at the Ware's behest, renegotiated the contract with Rudolf to allow continued work, albeit at a much slower pace, until the latter's death on 1 May 1939 at the age of 82, leaving a few unfinished models illustrating plant diseases on his work table. In total, Leopold and Rudolf Blaschka created more than 4,400 botanical models representing *c.* 830 species and *c.* 170 families. *The Ware Collection of Blaschka Glass Models of Plants* is unlike any other botanical exhibition in the world.

The glass ferns and fern allies

The first ten fern species made from 1889 through to 1893 (see Table) only depict life-size fronds, or pieces of fronds, rather than whole plants with rhizomes and roots. Most of these fronds are also accompanied by one or two larger-than-life models of sori but, with the exception of

Table. Pteridophytes represented in *The Ware Collection of Blaschka Glass Models of Plants*.
An asterisk in the last column denotes those created for the life cycle series.

CURRENT SCIENTIFIC NAME	COMMON NAME(S)	YEAR	NUMBER OF MODELS
Dryopteris filix-mas	male fern	1889	21*
Polypodium vulgare	European polypody; wall fern	1890	2
Pteridium aquilinum	bracken; common brake	1890	4
Adiantum hispidulum	rough maidenhair fern	1891	2
Adiantum macrophyllum	maidenhair fern	1891	2
Adiantum raddianum	fragrant maidenhair fern	1891	1
Adiantum trapeziforme	fragrant maidenhair fern	1891	1
Blechnum occidentale	shammock fern; sinkhole fern; swamp fern	1891	3
Pityrogramma austroamericana	golden fern; gold fern	1891	3
Huperzia lucidum	shining clubmoss	1893	4
Phlebodium aureum	-	1893	6
Marsilea drummondii (as *M. elata and M. salvatrix*)	water clover; common nardoo	1893	5*
Marsilea quadrifolia	european water clover; water shamrock	1893	10*
Niphidium crassifolium	-	1893	2
Salvinia natans	water fern; floating fern	1893	11*
Selaginella inaequalifolia	-	1893	5*
Selaginella lepidophylla	resurrection plant; rose of jericho	1893	9*
Selaginella martensii	-	1893	6*
Selaginella rupestris	dwarf lycopod	1893	2*
Asplenium rhizophyllum	walking fern	1900	4
Asplenium alatum	-	1903	2
Asplenium scolopendrium var. *americanum*	american hart's tongue fern; deer's tongue fern	1903	2
Hemionitis rufa	-	1903	2
Onoclea sensibilis	sensitive fern	1903	4
Equisetum arvense	field horsetail; scouring rush	1913	4

FERNS AS ART

Water clover, *Marsilea quadrifolia* modelled in glass

Dryopteris filix-mas (the first set of pteridophyte models made for the collection), there was no attempt to illustrate the complete alternation of generations in these species. In 1893, the Blaschkas launched into another phase of their work in which they focused almost exclusively on showing, for comparative purposes, the life cycle characteristics of all cryptogamic plant groups: pteridophytes, bryophytes, algae, and fungi (which at the time were considered part of the plant kingdom). With the inclusion of the *Dryopteris* models made in 1889, four species of ferns and four species of *Selaginella* provide a detailed study of the alternation of generations in both homosporous and heterosporous pteridophytes.

Whether or not the Blaschkas realized that most extant pteridophytes are homosporous, they took the classic text-book example of *D. filix-mas* to illustrate all stages of the homosporous fern life cycle. This series contains 21 models, including sterile and fertile fronds, spores, the developmental stages of the gametophyte, maturing antheridia and archegonia, and transverse and longitudinal sections of various tissues to highlight cellular development.

The models depicting *Marsilea, Salvinia*, and *Selaginella* were presumably commissioned not simply to teach the complexities of the heterosporous life cycle, but also to emphasise the extent of ecological diversity among pteridophytes. The beautiful life-size model of *M. quadri-folia* (above), accompanied by magnified models of a ruptured sporocarp and the endosporic male and female gametophytes illustrate the life cycle and unusual characteristics of a rooted aquatic pteridophyte. The equally superb models of *Salvinia natans*, illustrate the life cycle stages and biology of this floating aquatic pteridophyte. Air bubbles trapped by hairs on the upper surface of photosynthetic leaves combined with air chambers inside these leaves help to keep the plant afloat. Other leaves which are permanently submerged, and are so highly modified that they look like roots, act as absorption organs.

Sporeling of "Dryopteris filix-mas" attached to gametophyte

Accuracy of the models

The life cycle series is of special interest since the Blaschkas faithfully document what was known about pteridophyte reproductive biology more than a century ago. Most models, including those of microscopic structures (e.g. the antherozoids of *D. filix-mas* reproduced at 2000 times their natural size), depict structural details just as a careful taxonomist would observe them under a modern microscope. They also included minute features such as the trichomes on the margin of the gametophyte of the same species reproduced at 500 times their natural size, which probably would not have been noticed by a casual observer. However, not all the models are completely accurate: the mature

spores of *D. filix-mas*, for example, were mistakenly interpreted as being pale, opaque, symmetrical structures with a smooth surface rather than brown, asymmetrical structures, with minute but characteristic protruberances. Nevertheless, with only this and a few other exceptions, the models in the life cycle series have withstood critical scientific evaluation over the decades.

Sources of botanical information

Particularly with the life cycle series, the Blaschkas relied heavily on standard references just as they had done for their zoological models. Illustrations published in Julius Sachs' books (one of the most influential German plant physiologists of the 19th century) were used by the Blaschkas as they had been liberally borrowed by many others. In addition, the Blaschkas based their models of the water fern *Marsilea* on the published drawings of Edmund Russow, a botanist based in Estonia, and Christian Luerssen, a botanist in Leipzig. In depicting *Selaginella*, the Blaschkas used the work of another German researcher, Wilhelm Pfeffer, but added a little "artistic license" by combining two of Pfeffer's illustrations to show a fuller longitudinal section of the sporophyll (spore-bearing leaf) and other significant structures. The Blaschkas also appear to have taken a little license by modelling a so-called *D. filix-mas* gametophyte with attached sporeling (*opposite*) from an illustration of *Adiantum capillus-veneris* in Sach's book. Had they really modelled a sporeling growing from a gametophyte of *D. filix-mas* then they would surely have shown the trichomes that are characteristic of the gametophytes and sporelings of this species (as they correctly reproduced in three other models of *D. filix-mas* gametophytes).

After the main 1893 life-cycle series, the Blaschkas, as a father and son team, did not make any more pteridophyte models. However, seven years later (1900), Rudolf working alone after his father's death produced the "walking fern", *Asplenium rhizophyllum*, an unusual North American species with simple fronds which form new plantlets at their tips. No reference information on the source material has been found, but judging from the animated style of the model, it is likely that he used live material.

Three years later (1903), Rudolf again returned to his studies of ferns and created models of four more homosporous species: *Asplenium scolopendrium* var. 'Americanum', *Onoclea sensibilis, A. elatum* and *Hemionitis rufa*. Unlike the earlier models, we know for certain that these glass ferns benefited from careful field observations and collections made by Rudolf himself. Records indicate that Rudolf obtained *A. scolopendrium* var. 'Americanum' and *Onoclea sensibilis* from a nursery in Southwick, Massachusetts during his first visit to America in 1892 and that he made detailed field notes, colour drawings, and herbarium collections of *A. elatum* and *H. rufa* when visiting Jamaica later the same year.

The pteridophytes did not occupy Rudolf's studies again for another decade when in 1913 he added four models of the field horsetail *Equisetum arvense*. Two of these are stunning life-size models of sporophytes: one of a fertile plant in the spring (overleaf), the other of a vegetative plant in the summer. These are accompanied by a detailed model of a sporangiophore (reproduced at 25 times its natural size) and by a model of spores accurately portrayed as being chlorophyllous with elaters (reproduced at 250 times their natural size). These were the last pteridophyte models made by Rudolf. They and the 2 models of *A. scolopendrium* var. 'Americanum' are among the finest in the collection and must surely have been modelled from live material.

Asplenium alatum

Research on the collection

To date most of the research on *The Glass Flowers* has concentrated on aspects relevant to their conservation and repair. Specialists were recruited to examine, chemically and physically, the glass and composite materials used to make the models. From this analysis we learned a great deal about the Blaschkas' glass-working methods, many of which were not adequately documented in the Botanical Museum archives. The pteridophyte models, like all the models in the collection, have a wire under-structure, much like a skeleton, that holds the glass fronds and roots together in the same way that a necklace would be strung with individual beads. Each pinna has a wire at its base which was inserted into the bead-like sections of the frond's stem

FERNS AS ART

and either glued or flame-fused into place.

Colour in the early models was achieved by painting clear glass parts before they were assembled. Even veins and other minute details were carefully painted on the glass in the appropriate colours and shades to reproduce accurately the natural appearance of each fern species. The models made around 1900, and later, benefited from Rudolf's growing interest and expertise in glass chemistry which he added to his family's glass making traditions. In his home studio furnace, he created the exacting variety of colours he needed to duplicate those in nature by making his own coloured glasses and enamels from raw materials (quartz sand) and

Sporangia of *Asplenium scolopendrium* var. 'Americanum' realised in glass

Field horsetail, *Equisetum arvense*: sporophyte and a single sporangiophore

metallic elements such as copper (for greens and browns), cadmium (for yellowish hues) and so forth. While he made fewer models, those he fashioned in this period such as the models of *Asplenium scolopendrium* var. 'Americanum' (see page 92) and *Equisetum arvense* (left) are astonishingly lifelike; from the exact nuance of shade to the replication of the fern's morphology, his skill reveals a perfectionist. Even a detail as small as the annulus around the sporangium in the magnified models was carefully composed of clear and reddish-brown coloured glass threads twisted like sugarcanes to crown the blown body of the tiny sporangium, most only 6-8 mm wide (above). The textures and other details are so accurately portrayed that one constantly needs to remind oneself that they are not real plants, but reproductions made of glass!

Although only about 15% of the total collection of glass plants is in storage awaiting conservation, this includes all the pteridophytes and about 100 species of gymnosperms and angiosperms. All the other models are on permanent display in a recently renovated gallery that attracts more than 100,000 visitors a year.

More information on the Glass Flowers and Harvard Museum's other natural history collections can be found on the website:

www.hmnh.harvard.edu

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THE BRITISH PTERIDOLOGICAL SOCIETY

Registered Charity No. 1092399

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The BRITISH PTERIDOLOGICAL SOCIETY was founded in 1891 and today continues as a focus for fern enthusiasts. It provides a wide range of information about ferns through the medium of its publications and other literature. It also organises formal talks, informal discussions, field meetings, garden visits, plant exchanges, a spore exchange scheme and fern book sales. The Society has a wide membership which includes gardeners, nurserymen and botanists, both amateur and professional. The Society's journals, the *Fern Gazette, Pteridologist* and *Bulletin,* are published annually. The *Fern Gazette* publishes matter chiefly of specialist interest on international pteridology, the *Pteridologist,* topics of more general appeal, and the *Bulletin,* Society business and meetings reports. **WWW site**: http://www.eBPS.org.uk. Membership is open to all interested in ferns and fern-allies.

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Back numbers of the *Fern Gazette, Pteridologist* and *Bulletin* are available for purchase from P.J. Acock, 13 Star Lane, St Mary Cray, Kent BR5 3LJ; E-mail: BackNumbers@eBPS.org.uk.